America's Network

JANUARY 15, 1998 | TECHNOLOGY FOR THE PUBLIC NETWORK SINCE 1909 | CAN $8.00 • US $6.00

TECHNOLOGIST of the YEAR

Sprint's Marty Kaplan takes technology to market

Also inside: Our 'Killer Apps' issue

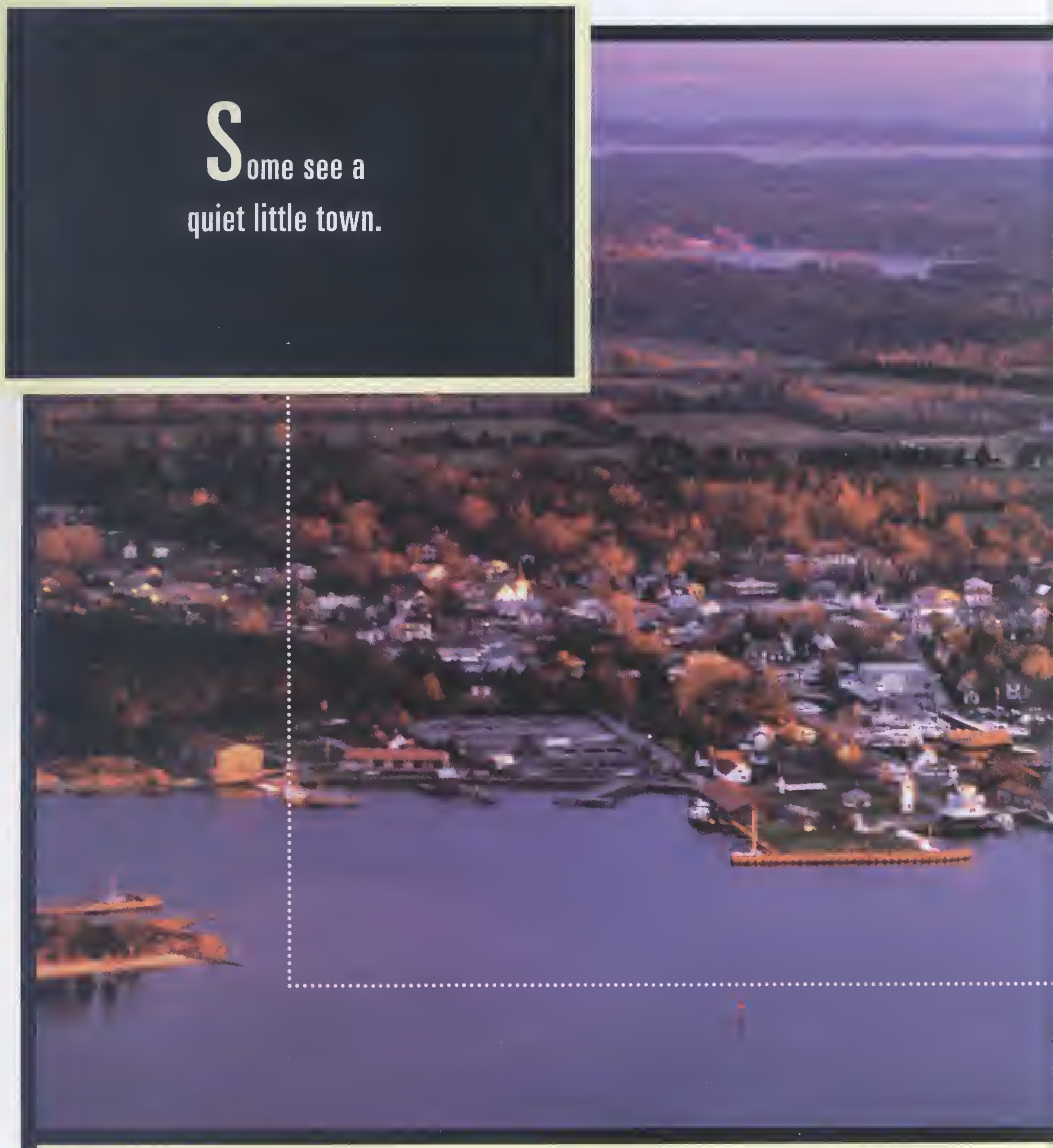
Deployment scenarios for:

- Distance learning
- Telemedicine
- Customer billing
- Voice over IP & VPNs

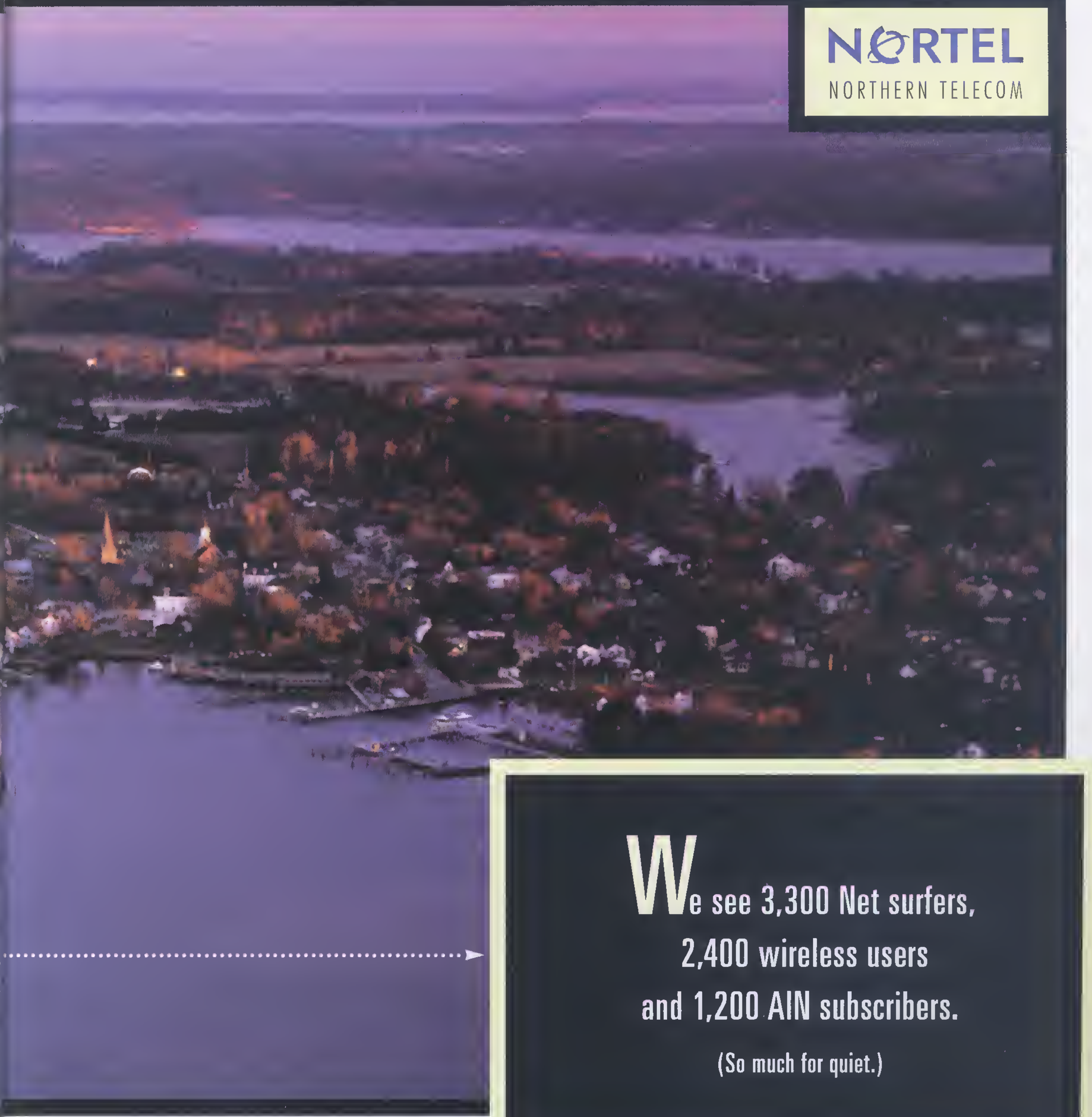
[redacted]

AN ADVANSTAR PUBLICATION

Some see a quiet little town.



The mayor strolls down Main Street talking to folks...on a wireless phone. Two neighbors play chess...over the Internet. Volunteer firefighters respond to the sounding alarm...of their beepers. Small towns will always have their charm, but with Nortel's DMS-10 system, they can also have the latest communications advantages. The DMS-10 system lets you offer AIN services and connection to wireless networks. Plus, it delivers both high-speed data and ISDN capabilities combined with proven reliability,


NORTEL
NORTHERN TELECOM
We see 3,300 Net surfers, 2,400 wireless users and 1,200 AIN subscribers.
(So much for quiet.)

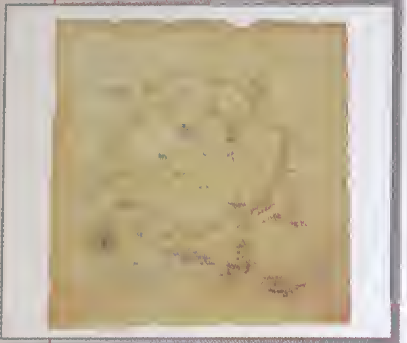
ease of operation and low start-up cost. For more information about Nortel's DMS-10 system, visit our Web site at www.nortel.com/dms10 or call 1-800-4 NORTEL, dept.1S. Whether you're expanding your current network or launching a new one, look to Nortel's DMS-10 system. Your market won't be so quiet anymore.

DMS-10

The future of your business.

©1998 Northern Telecom. DMS-10, Nortel and the Nortel globemark are trademarks of Northern Tele

Circle 100



[illegible] em thar' hills **Page 84**

[illegible] Auction Lady **Page 10**

[illegible] **Page 78**

Sprint's hands-on senior technologist.
Cover photo by Wakefield Photography (Kansas City, Mo.)
Page 30

America's Network Contents

January 15, 1998 • Volume 102 • Number 2

COLUMNS

8 **OBSERVATION DECK**
How now, Brown Cow? Cracking the code on local competition.
By Tom Pelto

10 **WASHINGTON BRIEFING**
The Auction Lessons. Watch for combinatorial bids in rounds to come.
By Susan Bahr

77 **INSTANT INSIGHT**
Profiling the killer app. America's most wanted? Service portability.
By Robert Rosenberg

102 **LAST CALL**
Bless those resellers. Keep your friends close, your 'enemies' closer.
By Alan Pearce

BROADBAND

30 **TAKING TECHNOLOGY TO MARKET**
Lessons learned from Sprint's change agent and chief educator, CTO Marty Kaplan—our Technologist of the Year. *By Alan Stewart*

38 **THE TELEMEDICINE BREAKTHROUGH**
Revenue gains could start this year. *By Charles Mason*

39 **UP-ENDING THE BOTTLENECK**
Interoperability opens way for cable modems. *By Charles Mason*

SERVICES

78 **BILLING WITH AN ATTITUDE**
Billing systems metamorphose into comprehensive customer management programs. *By Shira Levine*

WIRELINE

82 **EARNING AND LEARNING**
Telecommuting and distance learning aren't just show demos anymore.
By Annie Lindstrom

OUTSIDE PLANT

84 **FINDING BURIED TREASURE**
Carriers who know where they are will get where they want to go.
By Annie Lindstrom

INTERNET

88 **CHEAP ALTERNATIVES**
VPN, voice/IP can make profit sheets sing. *By David Kopf*

6 **From the Editors**
91 **Bitstream**
92 **Solutions**
- Ethernet technology establishes new standards
- Internet Solutions
- Products and Services

98 **Itinerary**
101 **Advertisers' Index**
How to contact *America's Network*

GRAB YOUR HAT AND LET'S GO!

THE EZ-TESTER® II MAKES CHILD'S PLAY OF SONET, DS3, T1 AND DSO TESTING.

Please send me more information about the EZ-TESTER® II.

Name____

Title____________________ Company____________________

Address____

City____________________ State______________ Zip____________

Phone____________________ Fax____________________

e-mail____________________

Electrodata, Inc.®

23020 Miles Road, Bedford Heights, Ohio 44128-5400
(800) 441-6336 • fax: (216) 663-0507
email: sales@electrodata.com

Meeting Your Testing Needs Today and Tomorrow

on the Internet, visit **http://www.electrodata.com**

Electrodata, Inc.®
Meeting Your Testing Needs Today And Tomorrow

Circle 101

Made in USA

Electrodata, Inc.®

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST- CLASS MAIL PERMIT NO 1270 CLEVELAND OH
POSTAGE WILL BE PAID BY ADDRESSEE

ELECTRODATA INC
23020 MILES ROAD
BEDFORD HEIGHTS, OH 44128-9924

[illegible] Pag

[illegible] Auction Lady Page 10

[illegible] ing in billing Page 78

Sprint's hands-on senior technologist.
Cover photo by Wakefield Photograph
(Kansas City, Mo.)
Page 30

CTO Marty Kaplan—our Technologist of the Year. *By Alan Stewart*

38 **THE TELEMEDICINE BREAKTHROUGH**
Revenue gains could start this year. *By Charles Mason*

39 **UP-ENDING THE BOTTLENECK**
Interoperability opens way for cable modems. *By Charles Mason*

SERVICES

78 **BILLING WITH AN ATTITUDE**
Billing systems metamorphose into comprehensive customer management programs. *By Shira Levine*

WIRELINE

82 **EARNING AND LEARNING**
Telecommuting and distance learning aren't just show demos anymore. *By Annie Lindstrom*

OUTSIDE PLANT

84 **FINDING BURIED TREASURE**
Carriers who know where they are will get where they want to go. *By Annie Lindstrom*

INTERNET

88 **CHEAP ALTERNATIVES**
VPN, voice/IP can make profit sheets sing. *By David Kopf*

6 **From the Editors**
91 **Bitstream**
92 **Solutions**
- Ethernet technology establishes new standards
- Internet Solutions
- Products and Services

98 **Itinerary**
101 **Advertisers' Index**
How to contact *America's Network*

SONET, DS3, T1...CHILD'S PLAY!

EZ-TESTER® II

Electrodata introduces the EZ-TESTER II, a new generation test set that adds DS3 and SONET testing to the comprehensive T1 and DS0 capabilities you expect from Electrodata. The EZ-TESTER II is truly easy-to-use and makes child's play of testing data transmission services in a rugged, hand held and truly affordable test set.

Keeping an Electrodata tradition, the EZ-TESTER II is **FORWARD** compatible. You purchase only the capabilities you need today, then easily add additional capability as required. Start with T1 or DS3 testing, add SONET or special capabilities, such as Primary rate ISDN, only when you need them. With Electrodata, today's budget goes further and protects your investment for tomorrow.

For more information, call today **1-800-441-6336** or, on the internet, visit **http://www.electrodata.com**

Electrodata, Inc.®

Meeting Your Testing Needs Today And Tomorrow

Circle 101

Made in USA

From the Editors

MARY SLEPICKA

Killer vs. Killing

The only way to support the end users, according to Marty Kaplan, is to find out what they need, find out how to supply that need with the means at your disposal, then run like hell to get the services out.

Kaplan should know; Sprint's 'agent of change'—and our Technologist of the Year (see page 30)—has excelled in coaxing technologies through the business-case evaluation and onward to applications that attract the attention (and dollars) of millions of residential and business subscribers. In doing so, he sets the standard for Sprint engineers in how they analyze their influence on revenues and costs. The trick? Not new technologies. Rather, it's putting existing technologies to better use.

So—how to roll out 'killer' applications that don't kill the budget and that use technologies we already have? In this issue, our senior editors have chosen what we loosely call the Killer Apps—those external and internal applications that will drive deployment of technology in the public network arena.

For example, Charles Mason profiles the issues that will drive (along with some that may derail) the implementation of telemedicine applications to serve rural America (page 38). Dave Kopf illustrates how Internet service providers are gearing up for voice-over-IP service offerings, and the payback they should expect (page 88). Shira Levine focuses on how Quality of Service issues are fueling new capabilities for internal billing and customer care operations (page 78), and Annie Lindstrom shows how, with the right support from communities and governments, distance learning applications will drive deployment of new broadband networks (page 82).

Finally, Bob Rosenberg of The Insight Research Corp. gives us "Instant Insight" (page 77) into the true mission of any successful application—service portability. "Instant Insight" will be a regular column in *America's Network*, appearing monthly in our 15th-of-the-month issues.

Mary Slepicka

America's Network

EDITORIAL OFFICES
201 Sandpointe Ave., Suite 600
Santa Ana CA 92707-8700
☎ 714/513-8400 Fax 714/513-8634
http://www.americasnetwork.com

Executive Editor Wireline/OSP/General Matters	MARY SLEPICKA ☎ 714/513-8643 mslepicka@americasnetwork.com
Managing Editor **Web/Internet Editor** Internet	DAVID KOPF ☎ 714/513-8459 dkopf@americasnetwork.com
Senior Editor–Broadband Broadband/Midband/ Wireline/OSP	ANNIE LINDSTROM *In New York* ☎ 212/951-6735 Fax: 212/683-4257 alindstrom@americasnetwork.com
Senior Editor–Wireless Wireless/Broadband	CHARLES MASON *In Seattle* ☎ 425/482-2840 Fax: 425/482-6178 cfmason@ibm.net
Senior Editor–Services Network Mgmt./OSS/ Billing/Data Warehousing	SHIRA LEVINE *In Chicago* ☎ 312/553-8911 Fax: 312/553-8926 slevine@americasnetwork.com
Associate Editor Solutions/Bitstream	DEBBIE L.SKLAR ☎ 714/513-8698 dsklar@americasnetwork.com
Art Director	JON FRAZE ☎ 714/513-8652 jfraze@americasnetwork.com
Publications Assistant	REBECCA ITTNER ☎ 714/513-8422 rittner@americasnetwork.com
Contributing Editor	ALAN STEWART 0007541340@mcimail.com
COLUMNISTS:	
Washington Briefing	SUSAN BAHR sbahr@aol.com
Market Engineering	FRANK BERNHARD fbernhard@advanstar.com
Last Call	ART BROTHERS ALAN PEARCE
CONTRIBUTING WRITERS:	JOHN MADRID THOMAS NOLLE JOHN PESCATORE

EDITORIAL ADVISORY BOARD

SANJIV AHUJA (Bellcore)
MEHMET BALOS (Ericsson Network Systems)
GEORGE EDWARDS (ATIS)
DAVID KELLEY (MEANS Inc.)
GEORGE MAKHOUL (Price Waterhouse)
MANOJ SAXENA (3M Telecom Systems)
ROBERT SELLINGER (Lucent Technologies)
LORENE STEFFES (Transarc)
ROBERT STOFFELS (NECA)
THOMAS SUPER (Nynex Science & Technology)

BUSINESS STAFF *(see also page 101)*

Publisher	PAUL SEMPLE
General Manager	DANNY PHILLIPS
Senior Publisher	RAY SMITH

ABP ADVANSTAR TELECOM GROUP BPA INTERNATIONAL

WE TURN BIG IDEAS INTO REAL-WORLD NETWORK MANAGEMENT SOLUTIONS THAT WORK.

Put our technology and expertise to the test.

Okay, here's a big idea. How about working with the vendor who revolutionized the way many service providers provision and maintain their networks? The fact is, nearly every major local and interexchange carrier in North America uses Hekimian's operations support systems and remote test products. But quality products aren't the only reason we're the market leader. It's also our team of technically savvy pros who have what it takes to design, implement and support large scale network systems. Ready for some big ideas? Call Hekimian today at 301-590-3600.

HEKIMIAN

AN AXEL JOHNSON INC. COMPANY

15200 Omega Drive
Rockville, MD 20850-3240
www.hekimian.com

Circle 102

TOM PELTO

How now, Brown Cow?

Cracking the code on local competition.

Resale is a way to get in the market, but access to unbundled elements is a way to stay in.

I arrived at this title in the wake of the 8th Circuit Court's decision on rehearing, where it invalidated the FCC's rule that prohibited incumbent local exchange carriers (ILECs) from separating unbundled network elements (UNEs) that are currently combined in the local network. ("Brown Cow" also refers to the court's first decision in the *Iowa Board* case, in which it built what is called a "horse-high, hog-tight and bull-strong fence" around the FCC. This analogy suggests to me a difficulty distinguishing between a phone case and a farm case.)

The more recent decision creates uncertainty regarding the UNE platform, the end-to-end combination of network elements that are leased, in their existing state, by a competitive LEC (CLEC) to provide service. The platform is what many ILECs refer to as "sham unbundling" because, they argue, the platform is identical to resale. In fact, there are significant distinctions between the platform and resale: price, universal service eligibility, and the ability to offer exchange access and other services (including those the ILEC may grandfather) bundled. What the court has given us is "shame unbundling." The decision not only appears to permit disconnection of customers served via the platform, but encourages it.

Where are we? With respect to switched services competition, nowhere. We set out to scale Mt. Everest, but as we approached the summit, we were told by the court that we'd climbed the wrong mountain. The real one is taller and at least as difficult, if not impossible, to climb. *How did we get here?* We set off in 1996 seeking the platform, but we developed a hitch in our giddy-up. We have the 8th Circuit to blame or thank.

Why does it matter? Because the UNE platform is the key to switched services competition. Resale is a way to get in the market, but access to unbundled elements is the way to stay in the market. Resale is a way to offer a lookalike, undifferentiated service without exchange access and lose money doing it. Unfortunately, what you lose on each customer is not made up in volume. This is particularly true with ILEC operations support systems that cannot handle volume; so, in addition to losing money, you get to make your customers wait. Unbundled elements are the way to offer differentiated services on an equal cost and revenue footing with the ILECs.

UNE combinations are at the heart of AT&T's local strategy, at least for residential and small business customers. I'm convinced that without non-discriminatory access to UNEs at cost-based prices, switched services competition will remain indiscernable for the foreseeable future. That's not the world which Congress intended.

Where do we go from here? That depends on whom you ask. As a lawyer, I see serious questions regarding the validity of the 8th Circuit's holding. But few business people are inclined to bet that the court changes its mind or that the Supreme Court hears and reverses the decision. Many ILECs would answer by saying competition now requires collocation cages—that a CLEC must be physically collocated in every central office out of which they serve customers using UNEs. Not surprisingly, AT&T rejects that view:

- Some access to UNE combinations must be required. You can't fix the problem by simply striking the platform provisions that exist in many if not most AT&T interconnection agreements. Something must take its place.
- CLECs are entitled to offer services exclusively, using UNEs, without having to install their own network facilities first. Any solution requiring physical collocation or other CLEC facilities is inconsistent with court rulings.
- The proposed solution must be practical, technically feasible and provide non-discriminatory access, equal to what the ILEC gives itself when it provides retail service.

I believe there is no practical, technically feasible and non-discriminatory solution other than the UNE platform.

Likely, the state commissions will have to decide whether it is the platform or bust. The latter is awfully unappealing (no lawyer pun intended). So the final question is not so much *How now*? but *When?* The answer is when the UNE platform—or a close substitute permitting non-discriminatory access to UNE combinations—is ordered or agreed to—and implemented. Only then will we see the emergence of widespread switched services competition in the local exchange. Until then, "local competiiton" will remain an oxymoron. ■

Tom Pelto is vice president of law and government affairs for AT&T's western office. Column is excerpted from a speech given by Pelto in November at the Iowa Telecommunications Association annual meeting.

Place added intelligence in the hands of your Sales & Marketing teams. *INTELLIGIZE* them with AUTONET/*Advisor* - the *new* integrated Data & Voice Network Design & Quotation System.

AUTONET/*Advisor* is designed to help you create the 'Intelligent Workforce'. When you *intelligize* with AUTONET/*Advisor* you will:

- **Enhance the knowledge base of your workforce** with precise service specs, option & packaging descriptions, & accurate pricing.
- **Ensure consistent, enterprise-wide interpretation of pricing rules** by using a single, integrated tool for all existing and future services.
- **Deliver enhanced productivity** with 'single source' access to most switched & dedicated data & voice services including Frame Relay, Private Line, ISDN & VPN. Over 4000 RBOC, IXC & International tariffs are supported.

- **Provide value added services to your Customers** with the 'auto design' capability for star, mesh and ring networks.
- **Enhance responsiveness to Customers:**
  - 32-bit Win95 or NT application
  - Easy-to-learn & use, it's entirely graphical, point & click, cut & paste
  - Seamless integration with MS Word & Excel via MS OLE
  - Reports in Word, Excel *or* HTML formats
  - Compare competitive carrier offerings *graphically in seconds*

Ready to *Intelligize*?

Call NDA now at 905-477-9534 ... or check us out on the Web at www.ndacorp.com.

Network Design and Analysis Corporation
Worldwide Data & Voice Network Design & Quotation Systems

'Intelligize your workforce'

© Copyright 1997 Network Design and Analysis Corporation. All rights reserved. AUTONET software products are copyrights of Network Design and Analysis Corporation. All other company end product names are trademarks or registered trademarks of their respective owners.

Circle 103

SUSAN J. BAHR

The Auction Lessons

Watch for combinatorial bids in rounds to come.

From the first narrowband personal communications services (PCS) auction in 1994 until the wireless communications services auction in 1998, Muriel Watkins was responsible for auction operations at the FCC. Now principal of MW Financial Inc., providing consulting to entities interested in participating in auctions and related proceedings, Watkins discusses how future auctions could be different.

Explain what you did at the FCC.

Watkins: I was deputy chief of auctions operations in the FCC's Wireless Telecommunications Bureau [WTB]. My initial responsibility was to staff an Auctions Division and to expedite the competitive hiring of an auction company for future auctions. Before coming to the FCC, I worked at the Resolution Trust Corp. (RTC) which auctioned the real estate left from the savings and loan crisis. So I had experience with auctions and with designing programs to provide opportunities for small businesses.

How do you think small businesses fared?

I think small businesses did well in the auctions.

But what about the problems some small businesses are having making payments on their broadband PCS C Block licenses?

Those problems are isolated to the C Block auction. The bid prices exceeded all expectations and were higher proportionately than the prices in the prior PCS auctions. The financial community is concerned about the true value of the C Block licenses. In other auctions, small businesses did well, especially in the regional narrowband PCS auction.

After the C Block payment problems began, the commission began to think that it shouldn't have both a regulatory role and a financing role for the same companies. I think that the Telecommunications Development Fund could take over the financing role. The TDF's mandate is to help small businesses enter the telecommunications industry. The TDF is separate from the FCC. The board members are not commission staff and are not responsible for making the auction rules or reviewing waiver requests. The TDF may be able to develop a credit program to support successful auction bidders. I think the TDF currently has about $20 million. The money comes from interest earned on bidders' funds held by the commission.

The original rules for the PCS C Block auction gave discounts to businesses owned by minorities/women. But then, in 1995, the Supreme Court issued its Adarand decision which made it difficult, if not impossible, to give such discounts.

After the *Adarand* decision, the rules were changed to focus on and provide discounts or installment payments for small businesses. In a number of auctions, there have been two tiers of small businesses [in] an attempt to give a special advantage to minority- and women-owned companies based on the fact that they generally are the smallest of the small companies.

The FCC has a pending rulemaking for auctioning broadcast licenses. Initial comments are due by Jan. 26 with reply comments due Feb. 17. The commission has asked whether or how it can give discounts to minority- and women-owned businesses. But it's possible that the same result could be achieved by giving special advantages to the smallest companies.

It's the percent discount, I think, that's going to make the difference. In the first PCS nationwide narrowband auction, there was a 25% discount on the bid price for small companies. But there was such a pent-up demand for spectrum, the small businesses were outbid early on. So in the regional narrowband PCS auction, the commission used a 40% discount which allowed small companies to be competitive with large companies in the same auction.

The commission recently adopted tiered discounts up to 35% to be used in any auction. This could help encourage the participation of minority- and women-owned companies, which is an issue in another open rulemaking concerning rules applicable to all auctions.

The Budget Act of 1998 requires the FCC to use auctions for almost all wireless services. But there are several pending comparative hearing cases for broadcast licenses for which the FCC may not need to use auctions.

Those claims are similar to "encumbered assets." At the RTC, there were tenants in the buildings we were going to auction. We had to figure out how to treat those "encumbered assets." We offered the tenants the right of first refusal to acquire the properties they were living in, and if they refused, then we sold it.

One way of handling pending comparative hearing cases at the FCC would be to combine a right of first refusal with the pioneer's preference rules. At the conclusion of the auction, the average value of the spectrum in the nation or region would be the price the entity would pay. That's what happened with the broadband PCS pioneer's preference licensees like American Personal Communications.

The local multipoint distribution service (LMDS) auction scheduled to begin in February will not have installment payments. Winning bidders will have to pay cash. What's the impact?

You're going to get companies that have sufficient capital. They'll probably have an established relationship with a lender. There was some concern about a number of bidders who came into the earlier auctions—startup companies that really didn't have a track record and had questionable management. Those companies will not be involved in the future.

Won't that rule out many small businesses?

Small is relative. Small businesses coming to the auctions will be ones that already have some involvement in the industry, or are headed by entrepreneurs with involvement in the industry. And they probably have access to capital or a commitment of capital.

People are wondering what the FCC will do with a license if the wireless system isn't built out as fully as is required by the FCC.

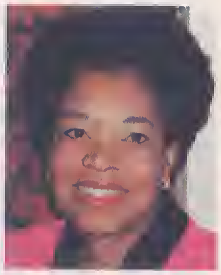
The [WTB] was considering elimination of the buildout requirement. This position was discussed in Greg Rosston's paper, "Using Market-Based Spectrum Policy to Promote the Public Interest," which is available on the Internet. Commissioner Susan Ness objected to that report, and debated the issue with former [WTB] Chief Michele Farquhar. Because Rosston and Farquhar are gone and Commissioner Ness remains, that whole issue will probably be revisited.

How will auction operations change?

The commission will continue with computerized auctions with the focus on simultaneous multi-round auctions—meaning many licenses are bid on at the same time, and the auctions go through many rounds of bidding. But the Budget

'Because the [FCC] does not have the mandate to maximize revenues through auctions, there's an opportunity to experiment with other methodologies and approaches.'

—Muriel Watkins



*Are you REALLY meeting the **Bellcore** specification?*

Bellcore is performing a Technical Audit of Precicontact's product in 1997. A copy of the Technical Auditing Report will be available from Precicontact. Bellcore does not endorse or certify any product or service or guaranty its performance.

Messy lubricant attracts dust and dirt, campromising canductivity

Only the critical contoct surfaces are pre-treated an all Precicontact Pre-lubricated Sockets

There's an alternative to messy and costly manual lubrication of finished PCBs: Pre-lubricated sockets from Precicontact.

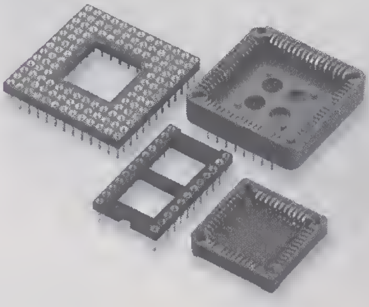
Learn more about our full line of pre-lubricated products and value-added lubricating services. For quality assurance and peace-of-mind, contact Precicontact at **(215) 322-3424.**

- Pre-lubricated sockets provide protection against fretting corrosion in Telecom applications
- Pre-lubricated sockets can be used for any long life application with tin-tin interface
- No degradation of lubrication during soldering or final wash
- Pre-lubricated sockets provide an alternative to costly manual lubrication on finished PCBs

Precicontact®

Swiss Precision-American Ingenuity

Circle # 104



Act of 1998 calls for the commission to experiment with the use of auctions with combinatorial bidding. That would allow bidders to pool licenses in one bid.

Let me get this straight. Right now, someone may need to place separate bids on Philadelphia, Baltimore and Washington. But with combinatorial bidding, they could place one bid for the three cities combined?

Yes. It's like a "bulk" sale. You weigh the combination to determine which combination has the highest bid price.

It sounds complex.

It is. And it calls for complex software. There was combinatorial bidding at the RTC. There, "bulk bids" had to be weighed against individual bids. Depending on what incentives you want to put in place, you may want to give a discount for "bulk bids" if you need to get rid of a lot of licenses at the same time. Or you could require the bulk bidder to bid 10% more than another bidder if you want to maximize your return on bulk acquisitions.

Because the commission does not have the mandate to maximize revenues through auctions, there's an opportunity to experiment with other methodologies and approaches.

The FCC plans to auction paging, specialized mobile radio (SMR), LMDS, location monitoring services and, perhaps, broadcast licenses this year. Do you have any advice for companies thinking about participating in these auctions?

The auctions present good opportunities for existing telecommunications companies to offer different services to their existing customers. Perhaps they could provide wireless services where they provide only wireline, and vice versa. They also may consider providing Internet access with wireless services. Auctions also are a great way for a new company to enter a niche market.

Companies should do their homework before coming to the auction. Review the rules, especially the penalty rules and collusion rules. Review the bidding strategies used in past auctions.

Basically, companies can do a lot of homework on their own. It's not necessary for every company to have a bidding consultant. But I think they should use an attorney who's familiar with the auctions, and they may want to use other consultants who can help them with their business plans. If the timing is right, they should participate in the corresponding rulemakings at the FCC. ■

Susan Bahr is a telecommunications attorney in Washington (sbahr@aol.com). Article does not constitute legal advice; persons seeking legal guidance for specific situations should seek direct counsel.

Your Power CeLLution

POWER *CELL* 1800 SYSTEMS provide the versatile, modular, power system specifically designed for high power cellular communication sites. Power *Cell* 1800 rack-mounted 19" and 23" systems are prewired for up to 4 or 5 plug-in, convection cooled rectifiers and may be easily field installed, as power demands increase. The rectifiers provide a 90% conversion efficiency with a 99% power factor, low harmonic distortion AC loading, and thermal overload protection.

Controller functions are available through the serial data link. Hendry's microprocessor based system may be configured for many unique requirements such as the control of loads, generators, or air conditioning.

Wireless '98
BOOTH 4855
WIRELESS 98

900 to 9000 WATT
Integrated System
Solutions

Cellular Site
MSC
PCS Wireless
BTS
Microwave
CO
Fiber Loop

ISO 9001
805.968.5511
Fax 805.968.9561
55 Castilian Drive
Goleta, CA 93117
http://www.hendry.com

HENDRY

Circle # 105

America's Network Subscribe FREE!

☐ **YES! I wish to receive (continue to receive) *America's Network* absolutely FREE!** ☐ **No**

SIGNATURE ____________ DATE ________
NAME ____________
TITLE ____________
COMPANY ____________
DELIVERY ADDRESS ____________
CITY ____________ STATE/PROVINCE ________
ZIP/POSTCODE ____________ COUNTRY ________
PHONE ____________
FAX ____________
INTERNET/E-MAIL ____________

To qualify for your FREE subscription, you must answer these FOUR questions: *(Fill in oval completely, as shown:* ●*)*

1. What is the primary business activity of your firm? *(Fill in **ONE** only.)*

100 ○ Telecommunications Carrier/Network Service Provider/Holding Co.
525 ○ Utility
575 ○ Computer Service Firm/Software Developer or Other Computer/Electronic-Related Industries
145 ○ Telecommunications Consulting/Engineering Co.
135 ○ Construction Contractor
152 ○ Telecommunications Equipment Vendor, Reseller, VAR or Distributor
500 ○ Finance/Investment/Banking
600 ○ Corporate/Private/Government Telecommunications User
625 ○ Association
400 ○ Other ____________ *(please specify)*

We reserve the right to reject any incomplete or unqualified requests.

2. Which of the following services does your co. provide? *(Fill in **ALL** that apply.)*

A ○ Interexchange Carrier/Long-Distance Service Provider
B ○ Local Exchange Carrier
C ○ Cellular Carrier
D ○ PCS Operator
E ○ Paging & Message
F ○ Satellite Communications
G ○ Other Wireless Operator
H ○ MSO (Two or more Cable TV Systems)
I ○ Independent Cable TV System
J ○ Cable TV Contractor/Engineering Firm
K ○ Other Cable
L ○ Competitive Access Provider (CAP)
M ○ Telecommunications Reseller
N ○ Internet Service Provider/Commercial Online Service Co.
O ○ Systems Integration/Outsourcing
P ○ Other Carrier
O ○ OTHER ____________ *(please specify)*

3. Which of the following describes your title classification? *(Fill in **ONE** only.)*

11 ○ **Technical Mgmt.** (Engineering VP, Director or Mgr.; Technical VP, Director or Mgr.; Network VP, Director or Mgr.; Plant Mgr.)
12 ○ **Engineering** (Network Designer, Engineer, Technician)
25 ○ **Data Communications/Digital/IS/MIS Mgmt.** (Data Communications, Digital, I/S VP, Director or Mgr.)
13 ○ **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
3 ○ **Corporate Mgmt.** (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
4 ○ **Legal, Financial, Regulatory or Processing Services** (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
5 ○ **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
16 ○ **Sales/Marketing** (Sales or Marketing VP, Director, Mgr., Representative)
20 ○ **Purchasing** (Purchasing, Materials, Contract VP, Director or Mgr.)
7 ○ **Other** (Co. Copies and Other Titled and Non-Titled Personnel)

4. Which of the follow equipment/services do you purchase, recommend, specify, approve or otherwise influence the purchase of? *(Fill in **ALL** that apply.)*

A ○ **Wireless/Cellular/Mobile/PCS Equip./Services**
B ○ **Central Office Equip./Services** (CO Switching Equip. [digital, ATM], Programmable Switches, Operations Support Systems, Workstations, CO Test, Hardware, Frames)
C ○ **Transmission and Broadband Distribution Equip./Services** (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
D ○ **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
E ○ **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
F ○ **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
G ○ **Data Communications/MIS/Network Mgmt. Support Equip./ Services** (including LANs, WANs, & Network Software)
H ○ **Power & Protection**
I ○ **Test & Measurement**
J ○ **Other** *(please specify)* ____________
K ○ None of the Above (A–J)

98B1

Fast action FAX: 1-218-723-9437

Free subscription offer valid in the U.S. and its possessions only. Canada/Mexico (24 issues) $95. All other countries (24 issues) $115.
☐ Add $90 per order for airmail delivery. Payable in U.S. dollars drawn on a U.S. bank.

FORE SYSTEMS.

Supplement to
America's Network

Advertisement

NO POSTAGE
NECESSARY IF
MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO 665 DULUTH MN

POSTAGE WILL BE PAID BY ADDRESSEE

America's Network
ADVANSTAR COMMUNICATIONS INC
PO BOX 6100
DULUTH MN 55806-9800
USA

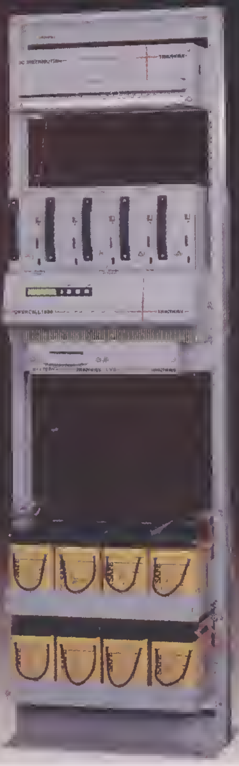
Your Power CeLLution

POWER *CELL* 1800 SYSTEMS provide the versatile, modular, power system specifically designed for high power cellular communication sites. Power *Cell* 1800 rack-mounted 19" and 23" systems are prewired for up to 4 or 5 plug-in, convection cooled rectifiers and may be easily field installed, as power demands increase. The rectifiers provide a 90% conversion efficiency with a 99% power factor, low harmonic distortion AC loading, and thermal overload protection.

Controller functions are available through the serial data link. Hendry's microprocessor based system may be configured for many unique requirements such as the control of loads, generators, or air conditioning.

Wireless '98
BOOTH 4855

WIRELESS 98



900 to 9000 WATT
Integrated System
Solutions

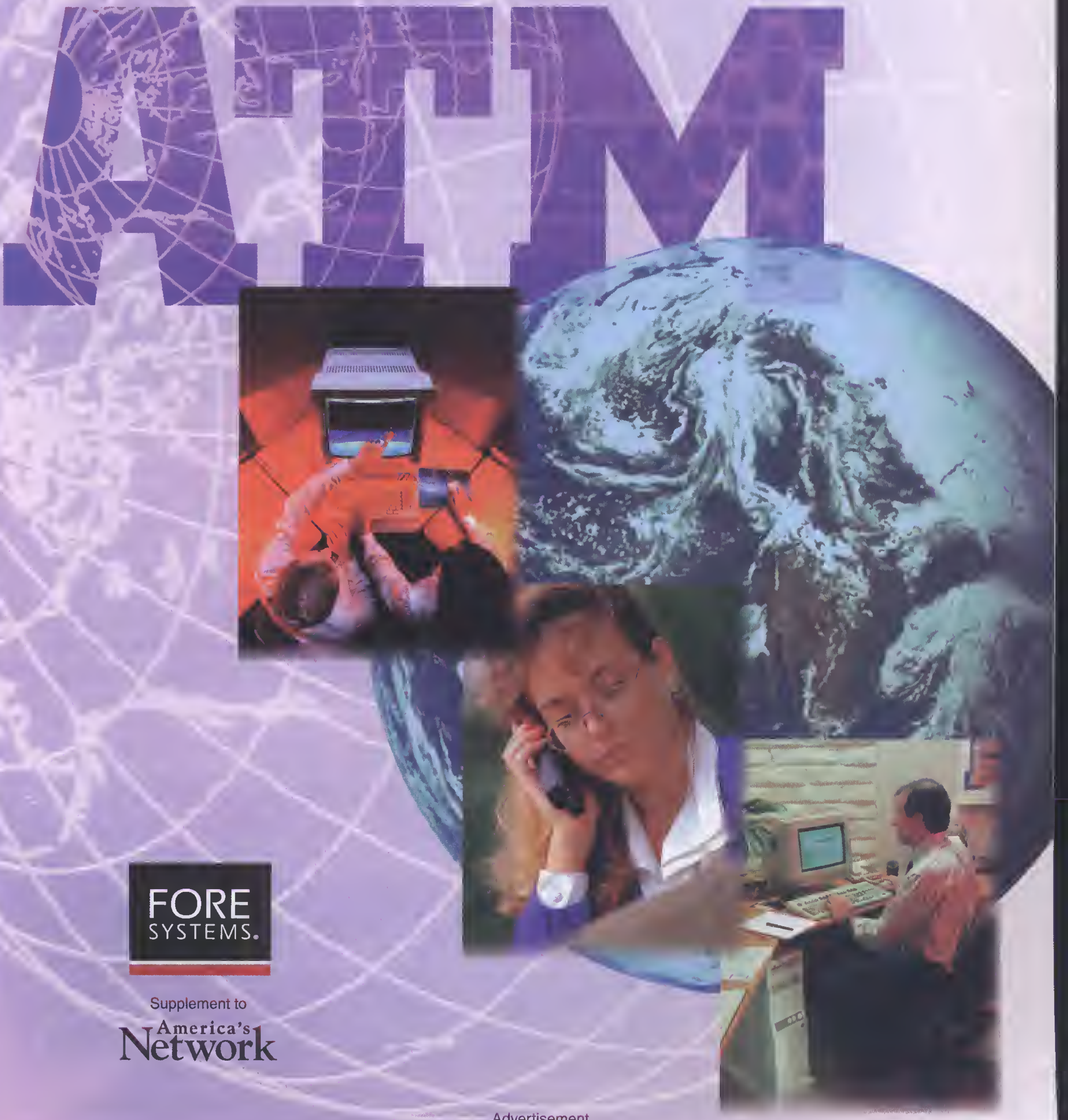
Cellular Site
MSC
PCS Wireless
BTS
Microwave
CO
Fiber Loop

ISO 9001
805.968.5511
Fax 805.968.9561
55 Castilian Drive
Goleta, CA 93117
http://www.hendry.com

HENDRY

Circle # 105

ATM: The Single-Network Solution



FORE SYSTEMS.

Supplement to
America's Network

Advertisement

The Universal Architecture

If you follow the NASDAQ you know it is heavily influenced by the share prices of small start-up companies. Some of these are in favor one day and not the next. Occasionally, they fall precipitately. On average, though, the general trend is up; so investors who maintain their holdings eventually make money.

Some companies do well from the start. Those that are adequately financed, well managed and based on good business principles are most likely to succeed. Being able to recognize these things makes the difference between a worthwhile investment and a poor one.

Technologies are like start-up companies—they fluctuate in popularity. Today, ISDN seems dead; but don't write it off—it may return in another guise. When frame relay was launched, business users barely blinked; but each year it gains in popularity. Sonet was once used only for long distance; now LECs, CATV companies and electric utilities employ it for access.

New technologies involve risk for their promoters. Those that are rooted in good engineering principles invariably do well in the marketplace, while those that are not fluctuate wildly. Telecommunications experts who understand this are like savvy investors—they know a good thing when they see it.

To be successful, a new technology must reduce complexity. It must not obsolete other solutions; it must integrate them. It must not fractionate networks; it must draw them together. It must not seek applications; it must pull them like a magnet. When it enters the public domain, it must inspire confidence in its investors.

Those who believe in ATM see it as a solution for the future.They believe it can bring out the best in other technologies by integrating them into a uniform infrastructure. And they believe this infrastructure will allow subscribers to communicate their multimedia data inexpensively and efficiently.

As you read the following pages we invite you to draw your own conclusions about ATM. Like a good stockbroker, we present you with the facts in the hope that these will cause you to share our enthusiasm. Would you like to invest in ATM—the unified network solution?

ATM Comes of Age

The public switched telephone network (PSTN) today is very much a hierarchical system. Over nearly a century, it has evolved with a single purpose in mind—to connect millions of analog telephone subscribers together at an acceptable level of service. In this context, it was obvious that digital technology would be applied principally to enhance this role rather than to change the fundamental architecture of the network.

Thus, once they enter the network, analog voice signals are modulated as digital bit streams, and are transported and switched using time division multiplexing (TDM). Although this works well for voice and voiceband data, it has many drawbacks when it is used to transport high speed computer signals.

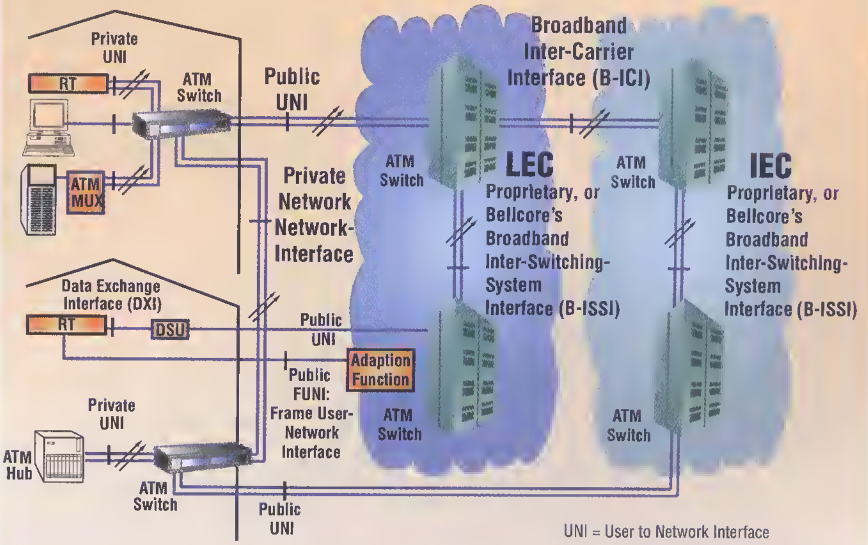
The reasons for this are self-evident:

- The basic digital voice channel is 64 kbps. This is combined with others and is transmitted over high-speed trunks.
- Circuit-switched networks use dialed numbers to connect subscribers together. These connections exist during the duration of the call, whether information is present or not.
- The network operates principally at the physical layer, meaning that does not adapt well to protocol-intensive data signals.

Only in the area of signaling has the digitization of the network had significant impact on data transport. Signaling System 7 (SS7) is an internationally accepted common channel signaling system designed to speed up call processing and provide a platform for intelligent network services.

Adapting the PSTN to be a more scalable, multiservice, wide area network (WAN) has proved to be a difficult proposition. In the 1980s, a global initiative to transform the analog network into an Integrated Services Digital Network (ISDN) encountered many problems, not the least of which were switching equipment incompatibilities. During the 10 years it took to resolve these issues, the backbone network improved to such an extent that many of ISDN's benefits were realized using business-oriented, packet based solutions such as frame relay and cell relay.

ATM FORUM "REFERENCE ARCHITECTURE"


Private UNI
RT
ATM Switch
Public UNI
ATM MUX
Broadband Inter-Carrier Interface (B-ICI)
ATM Switch
LEC
Proprietary, or Bellcore's Broadband Inter-Switching-System Interface (B-ISSI)
ATM Switch
IEC
Proprietary, or Bellcore's Broadband Inter-Switching-System Interface (B-ISSI)
Private Network Network-Interface
Data Exchange Interface (DXI)
RT
DSU
Public UNI
Adaption Function
Public FUNI: Frame User-Network Interface
ATM Switch
ATM Switch
Private UNI
ATM Hub
ATM Switch
Public UNI

UNI = User to Network Interface

Source: TRA, St. Mary's, Kansas

Advertisement

Because ATM provides a common solution for local and long distance data networking, it has hastened the convergence of computers and communications.

Public and private networks transport data in several ways—as TDM bit streams, as packets, as frames, or as cells. Asynchronous transfer mode (ATM) is the culmination of this long and expensive process.

Cells

ATM first came to the attention of the industry in the late 1980s as part of the International Telecommunication Union's (ITU's) Broadband-ISDN (B-ISDN) project. By 1989 the United States and Europe had agreed on a 53-byte (octet) ATM cell consisting of 5 octets of processing data (overhead) and 48 bytes of customer data (payload). Because ATM provides a common solution for local and long distance data networking, it has hastened the convergence of computers and communications.

ATM is a significant improvement over other packet technologies, for several reasons:

- Different kinds of information can be transported;
- The cell is fixed length and readily processed;
- ATM adaptation schemes support circuit- and frame-based information flows; and
- ATM scalability allows networks to grow as traffic demands require.

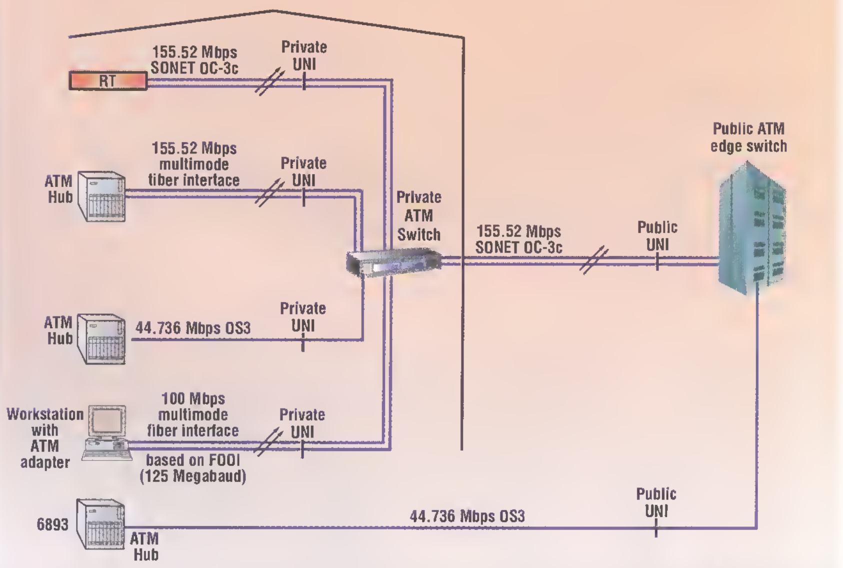
The advantages to the major public carriers were immediately obvious. For the first time, they had a technology that could be applied to building a seamless data network using internationally accepted protocols. This advantage translated into products that worked together using high-level protocols. Also, fast ATM cells were designed to be transported over the installed Synchronous Optical Network/Synchronous Digital Hierarchy (Sonet/SDH) infrastructure.

ATM switching

A major network element in an ATM backbone network is the ATM network switch. The ATM switch is the workhorse of the network, providing important network functions, including:

- Bandwidth management;
- Optimized connection management;
- Multiservice support;
- And more.

UNI CONNECTION BETWEEN PUBLIC AND PRIVATE ATM NETWORKS



Source: TRA, St. Mary's, Kansas

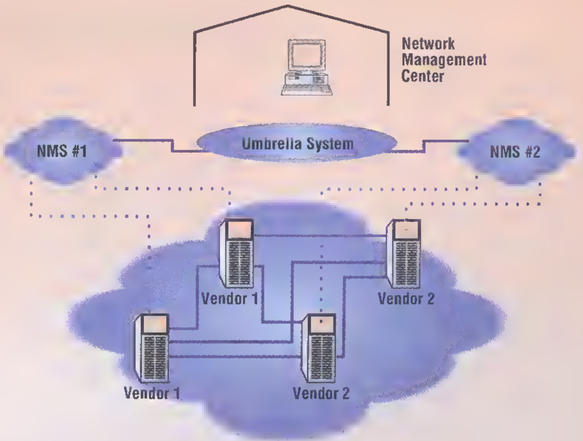
FORE Systems' TNX network switches are good examples of this class of product. Designed to work in harmony with a line of multiservice concentrators, TNX products offer network operators high performance ATM switching for the core of their data and multiservice backbone networks.

Using ATM access servers, concentrators and switches, a public carrier or an Internet service provider (ISP) can build a scalable, high performance switched ATM infrastructure. Such a network architecture includes the following equipment:

- Remote Access Server (RAS)—provides high density fan-in for dial-up users such as telecommuters and business travelers. The RAS equipment terminates the point-to-point protocol concentrating the data traffic onto 10/100 Ethernet or ATM network connections. RAS devices supporting ATM links can connect directly to the core ATM switch. Alternatively, an Ethernet LAN switch can be used to route traffic from a bank of RAS equipment on to ATM OC-3c connections to the ATM core.
- Multiservice Concentrator (MSC)—a relatively new network element that supports multiple access services on one chassis. It provides high-density consolidation of Frame Relay, PPP, ML-PPP and ATM services on to high-capacity ATM uplinks. Traditionally, these services terminated directly on the router and/or frame relay switch with a high capital investment per port. The MSC is optimized for high-density service concentration greatly reducing the equipment cost of network access.
- Network Switch (NS)—located at the core of the Internet Service Provider Network Access Point (ISP NAP). With this architecture, the ISP can construct a network that supports a logically meshed, single-hop backbone architecture, improving network performance and flexibility. The NS provides the switched connections between the RAS, the MSC, the router(s) and the Authentication Server, as well as the switched connection to the long-haul transmission network via DS3, OC-3 and OC-12 connections. In addition, the TNX-1100 can support any ATM-based Web hosting servers the ISP might deploy. Thus providers can offer multiple services over a common ATM core infrastructure. The MSC can be used to support ATM, Frame Relay, fractional T1/E1 and Internet access services to the customer locations. It concentrates these on OC-3c connections to the edge or core ATM switch, such as the TNX-110, which connects them to the appropriate service network and service providers. In this way, Internet traf-

PVC ESTABLISHMENT

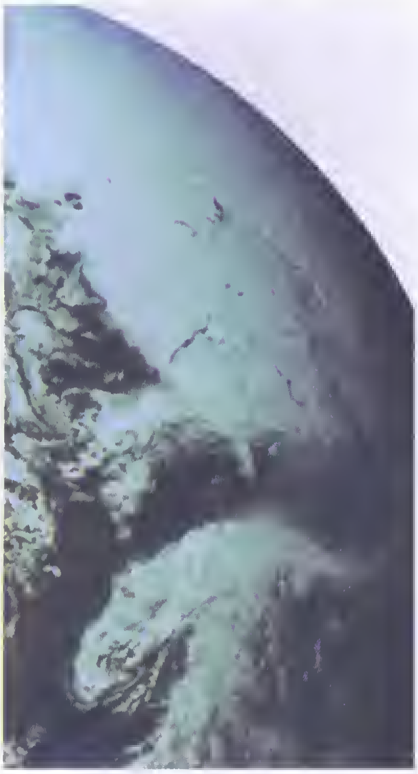
Switches from different vendors



- Umbrella system (e.g., HP Openview) allows separate windows on the same screen for NMS#1 and NMS#2
- Functionality of NMS#1 and NMS#2 is not integrated

NMS=Network Management System

Source: TRA, St. Mary's, Kansas



fic could be groomed onto ATM links that connect the local provider to an ISP. Voice traffic could be groomed onto ATM or TDM links connecting to the public switched network. Similar grooming and handoffs also could be performed for Frame Relay and ATM traffic.

Sonet and ATM

Public carriers realized early on that, to garner the maximum benefits from ATM, they must plan its deployment in harmony with the other emerging technologies. The basic building block of the backbone network today is Sonet, a transport technology that in recent years has also penetrated the access network. The power of a fiber-transported, synchronous network can be enhanced with ATM.

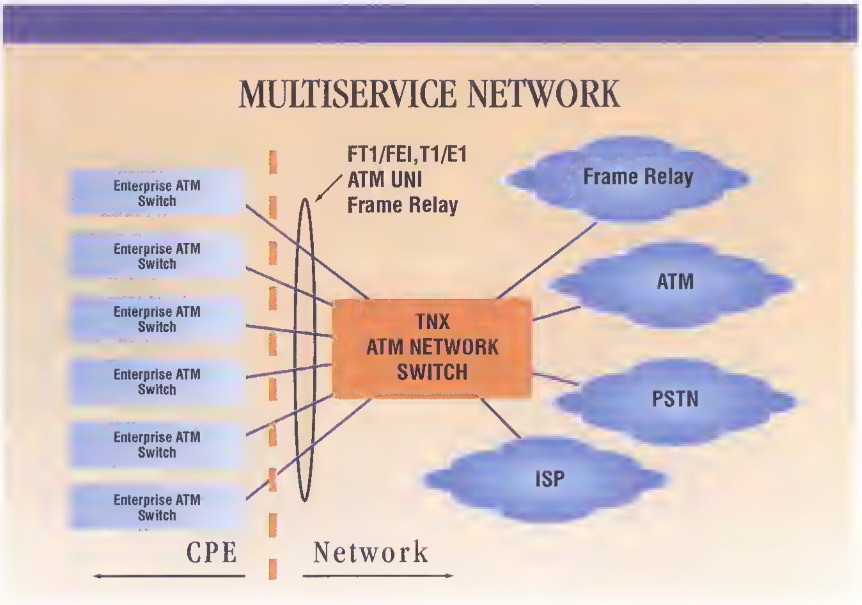
The cell-packaged customer payload is immediately accessible through the use of Add/Drop Multiplexers (ADMs). Because these process TDM bit streams, Sonet ADMs use overhead, require distributed maintenance, and are switched in the same manner as today's T-carrier channels. Because the ATM approach is cellular, synchronization is required only between the ports of the Send and Receive switches. Thus, traffic handled by an ATM ADM puts no additional load on the switching fabric.

The main priority of the carrier is keep network upgrade costs to a minimum. With ATM, the ADMs, switches and digital cross-connects (DCCs) are linked via existing Sonet-rate, point-to-point links. The format can be pure ATM per ITU recommendation I.432, the required overhead being absorbed by the OAM cells. Each ATM cell receives its timing from the transmit port data stream. Voice and video applications require synchronous residual time stamps for this synchronization.

In this environment, switches such as the TNX-1100 play a crucial role. They allow the carrier to connect the Sonet/SDH infrastructure that most major providers have in place to the local network that carries ATM customer data. These switches connect the backbone transport network using a variety of WAN ports at bit rates that include DS3, E3, OC-3 and OC-12.

Public ATM

During its early development, ATM was viewed as a public network backbone technology. A major issue for the regional Bell operating companies (RBOCs) was that, under the terms of the Modified Final Judgment (MFJ), they were unable to provide long distance service. Thus, public WAN coverage by each Bell company was determined by the Local Access Transport Area



(LATA). Despite this restriction, several local exchange carriers instituted public ATM services on a limited geographical basis. For example:

- Pacific Bell deployed public ATM service in a number of California cities in 1993. Initially, options were limited to permanent virtual circuits (PVCs) delivered at 45 Mbps over electrical and optical networks. A standardized user interface was an obvious priority and, by 1996, ATM UNIs enabled users to connect to the network at DS1 speed. Limited interLATA service over SVC connections was also provided.
- In 1992, BellSouth pioneered the North Carolina Information Highway (NCIH). This is a Sonet-based broadband WAN that uses both ATM, OC-3 access lines, and core Sonet switching. The North Carolina state government became the anchor tenant for this network during its early deployment. This resulted in a heavy emphasis on applications involving medicine and education. Switching computer data and video simultaneously was a major focus of the NCIH network architects.

Public ATM services are available from many providers. In 1994, variable and constant bit rate (CBR) permanent virtual circuits (PVCs) used DS3 access. A year later, these capabilities were provided over DS1 and OC-3 facilities. Network management information became available to end users. SVC service arrived in 1996 together with frame relay interworking and circuit emulation. Multi-T1 access interfaces followed using ATM inverse multiplexing. Priority levels per virtual connection and adaptive bit rate (ABR) services probably will make their entre next year.

Enabling technology

Over the past three years, ATM has ceased to be just another set of initials and has become a multibillion-dollar industry. Why is this? The simple answer is that ATM enables both carriers and end users to integrate their networks and expand them into the backbone network using common protocols and interfaces.

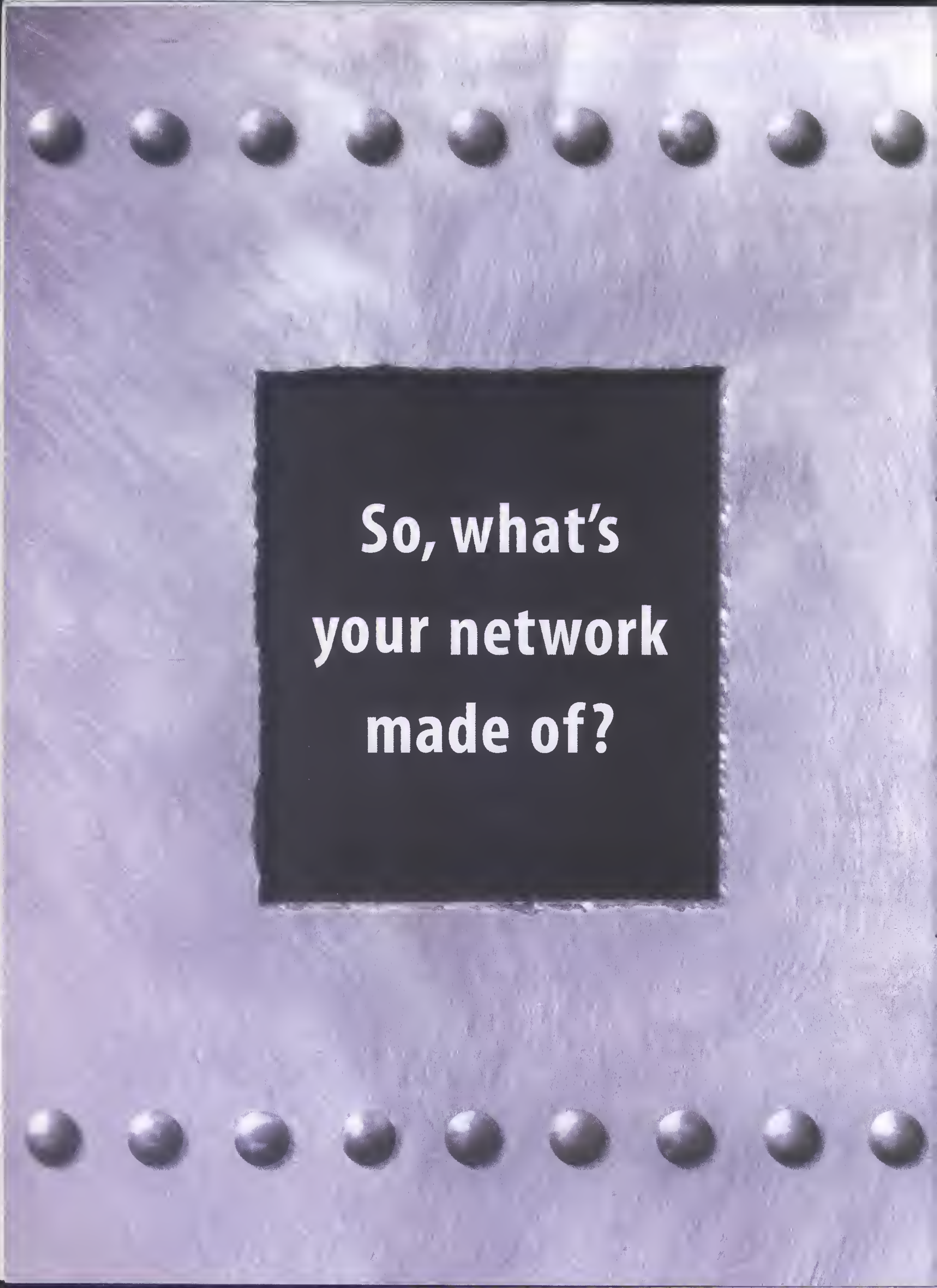
Network management is inherent in ATM networks. Users can run multimedia traffic in a campus environment and carriers can transport this traffic across long distance public and private message-switched networks.

The cost savings of this network integration are only just becoming apparent. As we become an even more information-intensive society, the demands placed on our telecommunications infrastructure will be intolerable without the support of a standardized data transport mechanism. Over the years, the circuit-switched public network will be replaced by a broadband, message-oriented communications infrastructure. The long term promise of ATM lay in its role of expediting this transformation.

The original role of the public ATM WAN was to connect ATM sites together over a virtual private network (VPN). However, as we have seen, most businesses utilize multi-protocol, multi-network telecommunications environments in which they attempt to consolidate both traffic and traffic management. Because of this, subscribers would like to integrate sites that network in circuit, packet, frame and cell. Over the coming months, public telecommunications carriers will build a backbone that can connect, transport and manage these services.

The 53-octet ATM cell is alive and well—and is ignored by information industry at its peril. Tomorrow's multimedia, managed, self-healing network cannot be realized without ATM and Sonet. All segments of our industry are crafting an ATM network for the next century. ■

As we become an even more information-intensive society, the demands placed on our telecommunications infrastructures will be intolerable without the support of a standardized data-transport mechanism.


So, what's your network made of?

FORE
SYSTEMS.

Networks of steel.℠

www.fore.com
1.888.404.0444

©1998 FORE SYSTEMS, INC.

Brains & Brawn

The tiny ATM cell is a powerful entity. Not only can it carry voice, data and video on its shoulders, but it can thread its way among a maze of dissimilar networks, provide information about its progress, and reach it destination quickly, efficiently and with a high guarantee of success. It can do this equally well in network environments that range from a college campus, an industrial park, a city, a nation or the world. It is this ability that makes it a smart and powerful tool for the users of mixed media data networks.

The smooth evolution of a broadband cell switched network depends on consultation and dialog between both providers and end users. The benefits of ATM to the latter lay in its ability to run their business applications over a network that is smart and robust. In other words, ATM is not just another Band-Aid solution for enterprise networks. Participation in the ATM evolutionary process is the only way to gain a better understanding of the service's long-term benefits.

Core network ATM

Today's public telecommunication network has taken on the task of switching not only voice but also data, noted Amir Ati and James Gordon in a Bellcore white paper published in October. "For the foreseeable future the public switched voice network will provide the majority of users with internet access via dial-up modems. The PSTN is a sophisticated system that offers an array of advanced features that cannot be matched with data networks in their present stage of maturity," they state.

ITU SERVICE CLASSES

	Class A	Class B	Class C	Class D	Class X	Class Y
Bit rate	Constant bit rate (CBR)	Variable bit rate (VBR)	Variable bit rate (VBR)	Variable bit rate (VBR)	Unspecified bit rate (UBR)	Available bit rate (ABR) w/congestion control
End-to-end timing relation	Yes	Yes	No	No	Transparent to switch. Best effort	No
ATM Forum class of service	CBR	Real-time VBR	Non real-time VBR	Non real-time VBR	UBR	ABR
Connection-oriented or Connectionless?	Connection-oriented	Connection-oriented	Connection-less	Connection-oriented	Connection-oriented	Connection-oriented
Quality of Service	Guarantees specified	Guarantees specified	Guarantees specified	Guarantees specified	No guarantee specified	Guarantees specified

ITU = International Telecommunication Union

Source: TRA, St. Mary's, Kansas

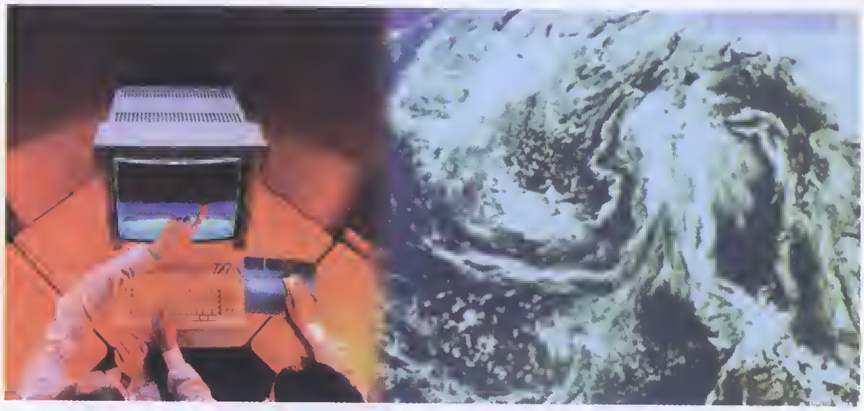
Thus, all the solutions proposed to date to reduce network congestion caused by the Internet recognize that data traffic must be off-loaded from the PSTN and transferred to a packet-switched network. The consensus is that this must take place as close to the subscriber as possible. In other words, there is general agreement that this kind of data is most efficiently carried by packet-switched networks. "By the year 2000 it is estimated that 30% of U.S. households will be on-line, compared with 15% in 1997."

The stakes are enormous. Ati and Gordon acknowledge that changes in calling patterns caused by this influx of data users will place intolerable burdens on the PSTN. The study concludes that "it may be advantageous for network providers and equipment suppliers to rethink overall network evolution to better understand the direction of the PSTN in terms of incorporating new technologies that would facilitate the support of all traffic types including voice, data and video applications."

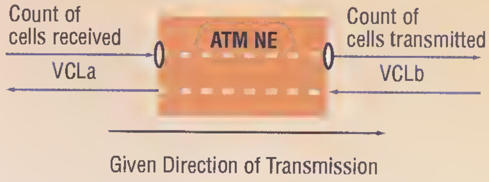
ATM to the rescue

This is where ATM comes in. A fixed length cell operating in a broadband intelligent network environment provides the best solution for not only Internet traffic, but for all kinds of multimedia applications ranging from high speed interactive data conferencing to full motion video. ATM is the logical next step in a long-term evolutionary process that began with packets and now includes high-speed frame and cell relay networks.

Major local exchange carriers (LECs) such as Pacific Bell and BellSouth deployed ATM first in the backbone network at OC-3 speeds and above. These applications were designed to work with Sonet and were designed with Broadband ISDN in mind. Over the last couple of years, the LECs' priorities have changed; today, their main focus is on providing end users with access to the ATM network at flexible bit rates and facilitating the use of ATM by a variety of other services including T1 and frame relay. For example, circuit emulation, which involves internetworking between a DS1 and ATM, maps the DS1 into ATM payloads, and communicates performance measurements and faults between the two network environments.



ATM PERFORMANCE MANAGEMENT MIB
ESTIMATION OF CLR ACROSS AN ATM NE



Cells lost count = count of cells received on VCLa – count of cells transmitted on VCLb

$$\text{CLR} = \frac{\text{Cells lost count}}{\text{Count of cells received on VCLa}}$$

Traffic aggregation

The International Telecommunication Union (ITU) specifies several classes of service including constant variable, unspecified, and available bit rates. Non-ATM network services that map to these classes of service include circuit switched traffic, frame relay, Internet protocol (IP) and Switched Multimegabit Data Service (SMDS).

It is a major advantage to the business community to be able to integrate different transport technologies and different kinds of payload, and use common network management functions over the WAN. The RBOCs either provide or plan to provide the following frame relay and ATM services over the ATM backbone:

- ATM backbone—frame relay access network;
- ATM UNI—ATM frame UNI service interworking;
- ATM UNI—Frame relay UNI service interworking;
- ATM backbone—DS1 access network interworking;
- ATM backbone—SMDS access network interworking; and
- ATM network—SS7 network interworking.

Over the next few months, business users will see carrier service announcements that provide end-to-end ATM service between subscriber access lines for ATM and non-ATM networking environments. To provide these ubiquitously, the major LECs are working closely with industry groups such as the ATM Forum, the Frame Relay Forum, the SMDS Users' Forum, and the Motion Pictures Experts Group (MPEG) to solve a number of issues, including:

- DS1 to ATM interworking—to interwork between a DS1 and ATM, DS1 signals must be mapped into the ATM payload, together with performance monitoring to detect lost cells.
- Non-ATM traffic aggregation—customers using non-ATM access lines to connect to the public ATM network require network interworking. To use an ATM backbone, internetworking with Frame Relay, circuit and SMDS access is required.
- Frame Relay to ATM—to interwork Frame Relay and ATM, the Frame Relay must

End-users bullish on ATM

ATM also is finding success in enterprise networks. Most end users of ATM view it as a viable upgrade to existing local area networks, according to a recent study by Sage Research. Researchers found that, although there is a belief among some people that ATM is installed mainly in new networks, 70% of users have actually installed it for upgrade purposes. For example, two-thirds used it to upgrade an existing Ethernet, while 13% employed it to enhance fast Ethernet. More than 40% supported token ring, while 42% used it to backup Fiber Distributed Data Interface (FDDI).

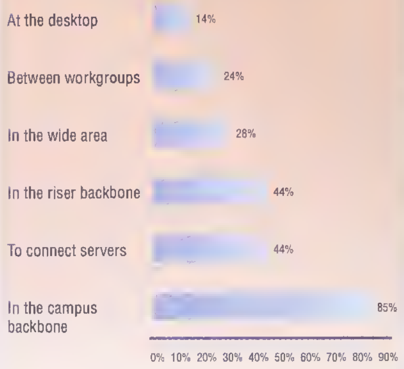
Most interviewees generally like ATM, says Kathryn Korostoff, Sage president. More than 90% of those using ATM said they plan to expand it to new locations within the next two years. The most common areas are server access or between servers. Those who said they'd recommend deployment to their peers totaled 87%. Those who'd had problems noted that these were mainly associated with specific brand products and not with the ATM technology itself.

Not surprisingly, ATM is often used in organizations with high- volume data requirements. Sage found that 83% of ATM traffic is data and only 17% of the total traffic is sensitive to delay or latency. The need for more bandwidth is the single most important factor, although there are other significant reasons. For example, for 78% throughput is a major concern, 76% needed to support high volume applications, and 73% required multi-protocol support. Quality of service is clearly an issue of some importance, along with the a desire to "future-proof" networks.

Users clearly are bullish on the technology. More than half said they expect to see over 75% of their network traffic running on ATM within two years. Clearly, most knowledgeable end users no longer view ATM as an "edge of the network" solution or exclusively for special organizational sub-groups. The consensus of most IS/IT departments seems to be that, over the long term, they will most likely migrate to ATM as the mainstay of their LAN backbone.

ATM HAS MULTIPLE ROLES

While many organizations may start using ATM in the campus, it is often used in more than one place.



In the wider arena,. fiber and ATM are a hit with the major telephone carriers. "[Sonet] combined with ATM switching equipment appear to be the answer for telecommunications service providers and large organizations looking to consolidate their voice, data and video needs on to one network," points out Frost & Sullivan's technology industry analyst, Grant Rose.

be mapped into the ATM. The joint ATM and Frame Relay Forum working groups specify this process. Functionality can be incorporated into the ATM network or the Frame Relay equipment. Encapsulated local area network data protocols are translated as necessary between ATM and Frame Relay.

- Operations, Administration & Management—OAM involves mapping each Frame Relay to each ATM circuit in each direction. The Interworking Function (IWF) keeps track of the Frame Relay data link connection identifiers (DLCIs) and the ATM virtual path and virtual channel identifiers (VPIs and VCIs).

ATM switching

End users and service providers are basing their new network infrastructures on ATM to support high-performance, multiservice networking. The TNX-210 and TNX-1100 ATM network switches from FORE Systems have been designed with this objective in mind. They provide a reliable and scalable ATM switching solution upon which to base these emerging next-generation networks.

Offering a broad range of ATM interfaces and a comprehensive suite of software-based features, the TNX ATM network switches enable users to build edge and backbone networks supporting a wide range of narrowband to broadband services. TNX-based networks can start small and be expanded to offer networking services to thousands of customers and locations.

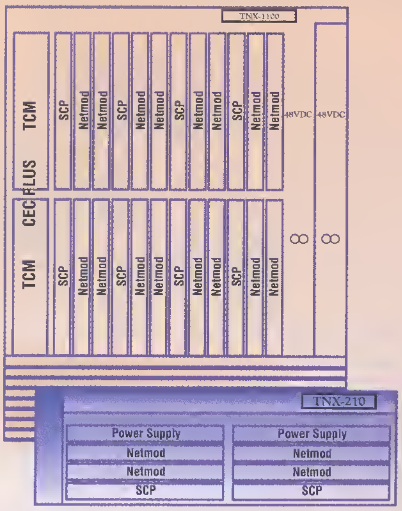
The TNX-210 and TNX-1100 combine the performance and resilience of high-capacity, non-blocking ATM switching with the intelligence and scalability of FORE-Thought networking software. The TNX-210 is a modular, 2.5 Gbps non-blocking ATM network switch that can support two to 24 ATM and non-ATM ports. Its small footprint and low cost make it an ideal platform for ATM service provisioning at small central offices and for ATM service extension to customer locations.

Future trends

Legacy telephone networks have problems accommodating changing calling patterns due to the Internet. These difficulties result in congestion in the switch and in the transport area. Most experts agree that the best long-term solution is to offload Internet traffic to a packet-switched network as close to the subscriber as possible. ATM provides an excellent vehicle for this purpose, as it is a basic building block of tomorrow's broadband public network.

Public carriers, many of whom are also ISPs, have a two-fold reason for building ATM networks. The first is to provide a cost-effective method of handling the congestion problem. The second is to put in place a major element of a broadband National Information Infrastructure (NII). ATM equipment can be put to work in both environments. ■

TNX-1100 and TNX-210 ATM NETWORK SWITCHES



- **Non-Blocking 2.5-10 Gbps ATM Switches**
- **Wide Range of ATM Interfaces: T1/E1, T3/E3, OC-3c/STM1, OC-12c/STM4c**
- **Support for T1/E1 Circuit Emulation**
- **Advanced Bandwidth Management**
- **Hot-Swappable Modules**
- **AC and DC Power**
- **Stratum 3/4 Synchronization**
- ***ForeView* Management**
- **NEBS Compliant**

ATM at Work

From the backbone of the largest Internet service provider (ISP) to the campus of the largest supplier of PC software, ATM is hard at work powering some of the world's most demanding networks. Amid the changes that have occurred in the last six years, one telling constant has been the success that users have experienced deploying ATM in enterprise and service provider environments.

ATM had early success as a high-performance LAN solution for universities, health care networks, research and development labs, government agencies, and other enterprise organizations. ATM now is well past the early-adopter stage, having been deployed in enterprise LAN and WAN networks in more than 50% of Fortune 500 companies. FORE Systems has been providing high-performance ATM solutions since 1991 and has more than 4,000 ATM customers worldwide. ATM has gone mainstream and is seen by network operators as a stable, reliable, production-ready networking technology upon which to base their communications infrastructure.

Worldwide revenue for ATM equipment and services is projected to be growing at a CAGR of 57% from $1.2 billion in 1996 to $7.3 billion in 2000. These are not statistics of a flagging market; rather, this projection is an indication of strong user acceptance.

Pumping up the backbone

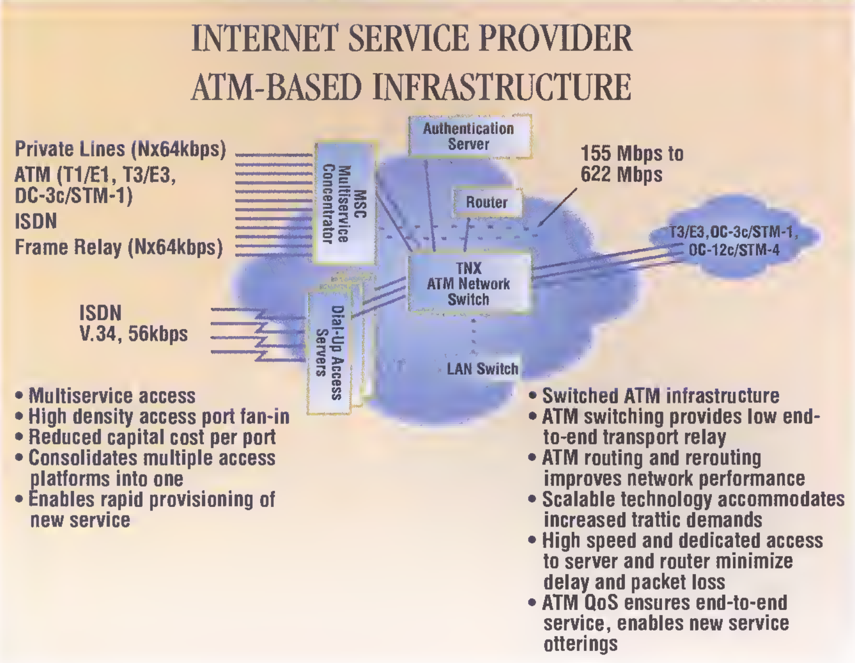
There has been significant growth in the deployment of ATM in service provider networks. Forecasts for ATM equipment sold to service providers project growth from $430 million in 1996 to $2.4 billion in 2000. Much of the recent ATM deployment has occurred in existing frame relay and ISP networks.

These revitalized ATM-based ISP and frame relay networks feature scalable backbone capacity, resilient connection services and low latency connections. ATM's low latency and Quality of Service (QoS) features are particularly important for providers that offer or plan to offer service-level agreements (SLAs). In a recent survey conducted by Vertical Systems, over 70% of the respondents indicated that SLA is an important decision criteria in selecting a service provider. This end user requirement and the need to differentiate service offerings are motivating network designers to implement networks capable of supporting service-level guarantees.

The emerging network model for ATM-based frame relay networks is one that moves existing frame relay switches to the edge of the network and introduces ATM as the backbone. Edge frame relay switches function as access concentrators, consolidating customers' frame relay traffic onto high-speed ATM connections to the ATM backbone. Mapping frame relay-to-ATM traffic is performed in accordance with the Frame Relay Forum's FRF.5 and FRF.8 Implementation Agreements. These standards specify all the key aspects of frame relay-to-ATM interworking, including how to map the payload PDU, flow control indicators, VC management information and traffic contracts.

FRF.8 (Frame Relay-to-ATM Service Implementation Agreement) specifies the method for mapping traffic from a single frame relay PVC to a single ATM PVC, and is typically used when users want to terminate traffic that originates on a frame relay access device (such as a router) directly on an ATM access product. FRF.5 (Frame Relay-to-ATM Network Implementation Agreement) specifies the method for mapping traffic from

FIGURE 1



INTERNET SERVICE PROVIDER ATM-BASED INFRASTRUCTURE

- Multiservice access
- High density access port fan-in
- Reduced capital cost per port
- Consolidates multiple access platforms into one
- Enables rapid provisioning of new service

- Switched ATM infrastructure
- ATM switching provides low end-to-end transport relay
- ATM routing and rerouting improves network performance
- Scalable technology accommodates increased traffic demands
- High speed and dedicated access to server and router minimize delay and packet loss
- ATM QoS ensures end-to-end service, enables new service offerings

multiple frame relay PVCs to a single ATM PVC, and is used when network operators trunk many frame relay connections between edge frame relay switches over a single ATM PVC.

This frame relay in the edge/ATM in the backbone network design is being adopted by all of the major Frame Relay service providers. The ATM-based design provides capacity for future network growth and enables service providers to offer end-to-end service-level guarantees. The ability to support QoS will become more important as SLAs become the yardstick by which customers measure their service providers.

At the core of the Internet

ISPs are building out their networks to handle the explosive popularity of the Internet. Indeed, some ISPs are seeing their traffic double every three to four months. To support this rate of growth, ISPs must implement networks that can be expanded easily, while avoiding major disruptions to existing services and users.

Two of the world's largest ISP operators, MCI and UUNet/WorldCom, have deployed FORE ASX-1000 and TNX-1100 ATM switches in their network access points (NAPs). ATM switches provide high performance switching within the ISP NAP and scalable, high-capacity trunking (up to 622 Mbps) between NAPs.

ATM switches are typically replacing an existing switched FDDI network with a switched ATM core. NAP data elements, such as the routers, servers and access concentrators, connect either directly to the ATM core or to LAN-to-ATM switches, such as FORE's ES-3810 10/100 LAN switch. Figure 1 shows a simplified diagram of an ATM-based ISP network using FORE's TNX-1100 10Gbps ATM switch; the NAP consists of remote access servers, ATM, frame relay and LAN switches, servers and routers.

Remote access server(s) provide fan-in for ISDN and analog dial-up users such as telecommuters and business travelers. This equipment terminates the PPP and ML-PPP connections concentrating the data traffic onto 10/100 Ethernet or ATM connections to the core network. Frame relay switches provide access to the ISP network. The frame relay switch concentrates frame relay traffic onto high-speed ATM links connecting to TNX-1100. Private-line services such as T1 and fractional T1 carrying PPP traffic connect directly to the access routers (ARs), which connect to the ATM core over ATM uplinks.

This architecture offers several important benefits to the ISP. First, the NAP's local data network—consisting of the dial-up access servers, frame relay switches, routers and authentication servers—is interconnected by a scalable, high-speed, low-delay ATM switched network. This is a significant improvement over the capacity-bound FDDI network, which cannot scale beyond 100 Mbps per link. In contrast, ATM links can scale from OC-3 to OC-192 (10 Gbps) rates, or 1,000 times the capacity of FDDI.

ATM core networks are already operating at OC-12c rates with OC-48c deployment planned for 1998. Servers used for dial access authentication and Web hosting and caching can connect to the ATM core at OC-12c rates—over six times the capacity of the earlier FDDI design. These higher speed server connections help improve server response times for network applications including user authentication and Web hosting.

The ATM network also brings benefits to the ISP's wide area network. The ATM infrastructure enables the ISP to build a virtual mesh backbone interconnecting all sites and ensuring that no network router element (e.g, routers) is more than one hop away from its neighbor NAPs. This single hop design reduces network delay and improves network performance.

Additionally, the virtual nature of the ATM core greatly simplifies networks adds and changes. For example, introduction of routers in networks based on point-to-point layer 1 designs requires the installation of new ports on those existing routers to which the new router connects and the provisioning of a new physical link between the routers. In the ATM-based network, adding a new link to an existing router is simply a matter of creating another virtual port on the router's ATM interface and establishing a new virtual connection across the backbone. This virtualization of equipment interfaces and network connections has similar advantages for other network elements as well.

Another important value of ATM is that it adds an intelligent layer 2 to the network. ATM is the intelligent infrastructure for the network backbone, featuring advanced layer 2 capabilities including automatic rerouting, auto-discovery, link load balancing , QoS-aware link state routing, fault isolation and performance monitoring.

Backbone networks based on non-ATM technologies such as Packet-Over-Sonet/SDH (POS) rely on the routers to recover from failed links to load balance across diverse paths and recalculate new routes when the network is expanded. The ATM-based network offloads the routers of these layer 1 and layer 2 operations, allowing the routers to focus on their layer 3 operations. In turn, the ATM infrastructure does what it does best: providing reliable virtual connections, simplifying network configuration and management, optimizing the use of network resources and improving end-to-end network performance.

The common denominator

ATM is finding its way into other service provider networks, as well. For example, competitive local exchange carriers (CLECs) and CATV companies, including TCG, Time Warner and Cox Communications, have deployed ATM in their backbone networks. Broadband services such as Transparent LAN Services (TLS) are being offered by a number of these companies on their ATM backbones. TLS provides a bridged Ethernet, FDDI or Token Ring service at native LAN rates (e.g., 10 Mbps, 100 Mbps) in a metropolitan area.

Some CLECs and cable companies are

positioning themselves to become full-service providers offering a range of voice, data, Internet access and video services. ATM is a natural fit for these companies because of its scalability and multiservice attributes.

Another motivation to implement ATM is related to the industry's move toward consolidation. ATM can be a common denominator among merging companies, simplifying the task of consolidating separate networks. Emerging service providers investing in new infrastructure might very well deploy ATM as much for its ease of integration with future partner networks as its advanced networking features.

Integrated services

As networks migrate to an ATM-based design, there is an opportunity to optimize them further, taking advantage of the common ATM infrastructure. Traditional service networks such as the PSTN, X.25, private line and frame relay have evolved as separate overlay networks, each requiring separate equipment and related support systems. Historically, the introduction of a new service required implementation of a completely new infrastructure to support the service (Figure 2).

Network operators that build ATM core networks can change this costly paradigm. These ATM-based networks will evolve to high-performance ATM in the core and high density, multi-service concentrators (MSC) in the edge. The MSC is a carrier-class edge device that concentrates a range of access services onto high-speed connections to the ATM core. In most networks, Frame Relay and PPP services terminate directly on a router and/or frame relay switch. This design has a relatively high capital cost per access port. On the other hand, the MSC is designed for high-density service concentration and reduces the equipment cost of network access.

MSC products enable network operators to provision multiple service offerings on a common chassis. For example, an MSC could support a large number of users and access services, including Nx64kbps private line, frame relay and PPP services. The MSC and ATM core replace the functions of today's frame relay switches, TDM I/0 cross-connect systems and router serial ports. This simplified network design is referred to as the Integrated Services Network (ISN); ISN eliminates the costs associated with separate overlay networks, consolidating multiple services onto a common edge and core network.

Network operators deploying an ISN will be able to respond quickly to changing market needs, adding and changing access services through simple configuration changes. Software-based MSC equipment will support software configuration of access protocols; for example, an Nx64kbps access port can be configured to support PPP at one time and frame relay at another time.

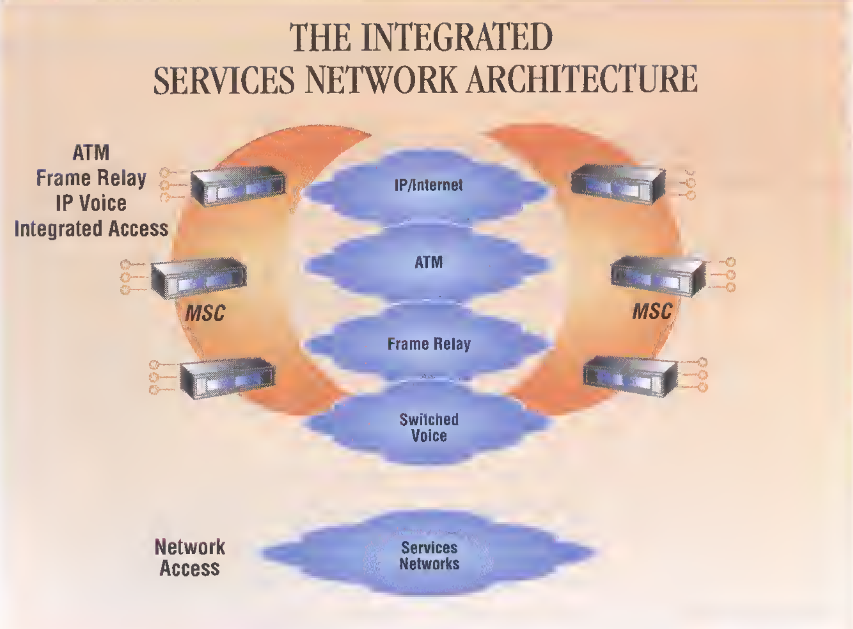
The ISN architecture is not limited to the service provider segment. All large, multiservice networks can benefit from this unified network design. The merits and benefits of this architecture are compelling, and FORE anticipates service providers will begin to evolve to this architecture in the next year.

The competitive edge

In six years, ATM has evolved from a high-speed LAN technology to a powerful networking solution for enterprise users and service providers. Already playing a vital role in frame relay and ISP networks, ATM will continue to grow in its importance in these and other service provider networks.

ATM is the intelligent infrastructure for broadband networks, providing a resilient, flexible, scalable and self-optimizing core network upon which networked applications can ride. ATM may have its largest impact in service provider networks. The ISN, based on multiservice concentration in the network's edge and ATM switching in the ATM network core, will simplify network design and dramatically reduce costs. This architecture will enable service providers to meet today's customer and market demands and be prepared for tomorrow, when time-to-market and service value will be the difference between losers and winners. ■

FIGURE 2



THE INTEGRATED SERVICES NETWORK ARCHITECTURE

Telecom
onferences
1 Event

LEC '98
The Conference for
Local Access Competition

ONG
STANCE '98
pportunities for Carrier's Carriers,
s, Resellers, Agents & Aggregators

ele-Competitors"sm
Conference for Utility, Cable and Other
New Telecom Service Providers

illing, Customer Care
nd Operator Services
ng Profits Through Outsourcing, Billing Software,
roved Customer Service and Bundled Services

puter Telephony,
Internet Telephony and
Internet Opportunities
ference for Internet & Computer Telephony
nities For Carriers & Resellers

se 5 Conferences
Located With:

leCard World™
Conference for Card-based
elecom Service Providers

onsored By:

CALL VOCALL COMMUNICATIONS CORP.
CENTURY TELECOMMUNICATIONS, INC.
SIEMENS
LCI
U.S. SOUTH COMMUNICATIONS INC.
Coyote
PfT TELEKOM™
HOMISCO
VOICENET

/Assoc. Sponsors:
.com
Telecom Business
TELECOMMUNICATIONS MAGAZINE
Wireless WEEK
TeleCard World™ Magazine
ips
America's Network
iaN
ITRE
The Utilities Telecom Report

(713) 974-5252 for more information

Telecom Business '98™
CONFERENCE & EXPOSITION

March 10-12, 1998 • Dallas Infomart • Dallas, Texas

Formerly Telecom Reseller Opportunities™ '97

Opportunities for Network Service Providers, Resellers and Suppliers and in the Competitive Telecom Industry

10 Reasons to Attend

Win a FREE Car

1. This event is like attending TRA, ALTS, Billing World, ACTA and CompTel in one show!
2. Six comprehensive conferences for companies that buy, sell, resell and bundle competitive telecom services — 55+ sessions in all!
3. The only conferences that focus on bottom-line issues that can make you money TODAY!
4. NEW! Special conference on Opportunities in Energy Resale!
5. TeleCard World™ '98 — now in its 5th year — is THE definitive industry conference for card-based telecom services.
6. NEW "Tele-Competitors℠" Conference explores the opportunities and competitive threats presented by cable and utility companies entering the telecom marketplace.
7. The latest in Prepaid Dialtone, Prepaid Cellular, Zero-Dollar phonecards, Voice Over the Net (VON), Enhanced Services and more.
8. FREE giveaways — including a chance to win a 1998 Chevrolet Camaro — for conference and exhibit hall attendees.
9. This is the conference for CLECs, CAPs, LECs, Agents, Resellers and other Network Service Providers, with innovative ideas on switching equipment, outsourcing and bundled billing to attract — and keep — more customers!
10. FREE copy of *Telecom Business Opportunities* book to the first 250 paid conference attendees, by *USA Today* reporter Steve Rosenbush.

PLAN NOW TO ATTEND

es
,
n-
ot
.
. I
lis-
)
ion
f
job
,
on
s
f
ie
y
.
ie
,
e to
s.
al
o
e
,
We
ng,
olu-
mu-
t
l
ds
l

ge 34

ALAN STEWART

Taking technology to market

Lessons are learned in an exclusive interview with Sprint's change agent and chief educator, CTO Marty Kaplan—our Technologist of the Year.

What is a chief technology officer? It's not a chief scentist. You may remember them: senior, professorial-like, seldom communicating directly with engineers. They gave their companies prestige, came up with lots of new ideas, and usually stayed away from the nuts and bolts of product design.

That's no longer true at Sprint, where chief technology officer (CTO) Marty Kaplan takes a leading role in innovation and project management. "Boundaries should not exist between a technology and its end result," he says. "My job is to help my company follow certain synergies of design and architecture that create seamless networks. How successful I am determines how well I guide the future direction of Sprint and its European partners."

It's been through Kaplan's efforts in guiding deployment of wave division multiplexing (WDM) throughout the Sprint network that the carrier has been able to increase its backbone capacity by four, eight and 16 times—without replacing equipment and investing in capital expenditure outlay. Kaplan's solution to Sprint's network congestion problem, and the unique, problem-solving process he engineered, earn him the recognition of *America's Network's* Technologist of the Year.

Is the industry evolving to fast? People are bombarded with new ideas, new products, new networks and new companies until their senses reel. This is particularly worrisome for those who spend their working lives in one company. As they try to keep current with their own field of work, they find less time to see the big picture, eventually reducing their understanding of how new technology is brought to market.

Someone who's avoided this trap is Marty Kaplan, senior vice president and chief technology officer (CTO) for Sprint Corp. (Overland Park, Kan.). He joined the company 25 years ago when things like fast-packet switching and synchronous optical networks (Sonet) were unknown. Now, he guides these and other new technologies through an extensive evolution, transforming them into services for millions of subscribers.

Kaplan chairs a group that plans the shape of Sprint's global backbone. "I forecast where the network nodes will be, which suppliers build them and which specifications they follow," he says. "Only by understanding how a technology can launch a new business direction can any individual provide effective leadership and judge the impact of technology on cost-competitiveness. A CTO must be not only an agent of change, but also an educator who can explain the purpose of change.

"Dealing with issues that transition narrow and broadband networks requires an understanding of what we are looking for in such transitions," he continues. "Leadership is needed in all the disciplines. You ask yourself, What should I be doing in a particular situation? How should I get ready? How best can I leverage my resources? What products should I look at? The problem

Photos © John Wakefield

with ATM [asynchronous transfer mode] in the early days was that it was driven more by its basic technology than by the needs of the marketplace. This led to a kind of lead/lag effect that confused our vision of what it was capable of really doing for end users."

TECHNICAL WALK-THROUGHS

Much of Kaplan's success at Sprint is his ability to see his role as something that can pay big dividends for the whole organization. One of his responsibilities is in the company's capital program. "I look at our investment in technology as a way of influencing our future," he says. "I constantly urge my engineers to analyze their influence on revenue generation, cost reduction and cost avoidance.

"The business case must relate revenue potential to the underlying cost structure," he continues. "This enables us to forecast what may happen early on in the development cycle. The danger is that my organization should not view itself just as a cost center; therefore, I try to grow it in terms of value. I find out who, because of their work discipline, can contribute at the highest level, and then I unleash resources to back them up."

Kaplan views this as a communication process. If enough information flows into a technology, it creates a sense of what it will ultimately produce. "Our job isn't done until we put a product into service and see it working smoothly," he explains. "That's the true distinction between today's CTO and yesterday's chief scientist."

A great idea, Kaplan says, will fail if it's not supported all the way down the line. Thus, Kaplan takes responsibility not only for the idea, but for the planning, integration, engineering, implementation and testing processes. "The only way I can measure my job is by answering a simple question: Did the customer benefit? That lets everyone to work toward a common goal," he says.

Sprint's 1997 long-distance capital expenditure of roughly $1.3 billion "needs a lot of hands-on control," he says, "so I chair what we call technical walk-throughs. The originator of the investment presents his or her case to the finance group and everyone else who's involved. All the disciplines are represented—systems development, operations, marketing and so forth. We ask the originator, 'What are you doing, how are you doing it and why in this particular way?' "

Sprint has a three-year network evolution plan that Kaplan personally communicated throughout the company—including the board of directors. In addition, "We have a five-year capital program that I'm in the midst of right now. I must know where the forecast came from and what it was based on. I try to make sure that everybody builds to the same set of expectations. This way, they understand what the capital

continued on page 34

WHEN FACED WITH COMPLEX NETWORKS, IT HELPS TO THINK LIKE A FIVE-YEAR-OLD.

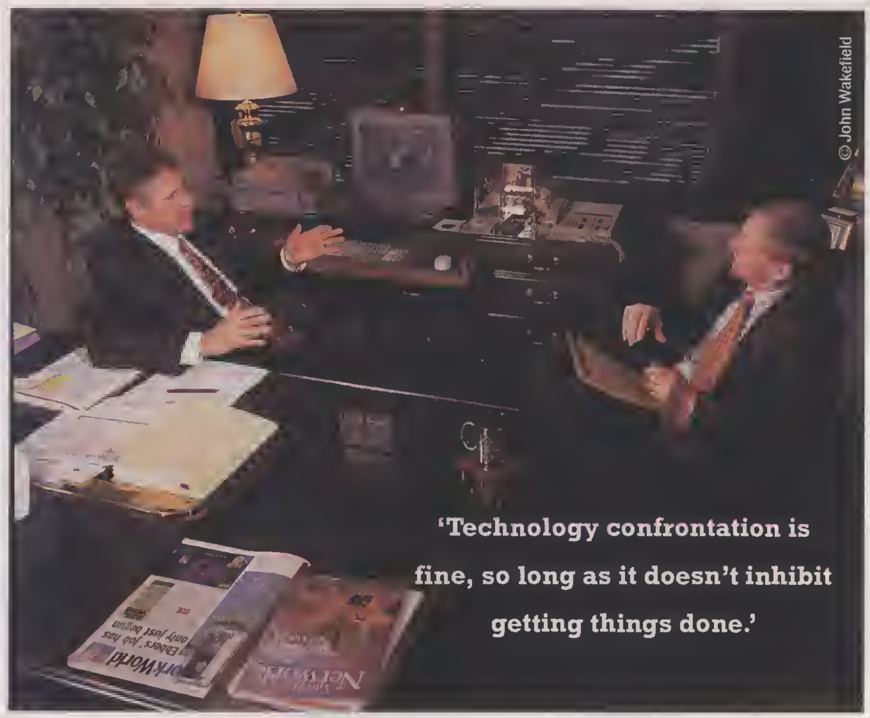
Testing awesome and complex networks can be, well, awesome and complex. Which is why we approach network testing of even advanced SONET, WDM, ATM, DSL, or CDMA networks with the simple nature of a child. For instance, menu driven screens walk you through detailed, automatic testing scenarios so you can push your networks, rather than push operating manuals. And for optical networks, advanced algorithms sniff out even the tiniest faults (often missed by other instruments) in over 100 miles of fiber. All of which makes testing your advanced networks easier for you — and more like, yeah, playing in the sandbox. Because if you can dream it up, we've got a way to get you there.

No matter how old you are, call 1-800-426-2200 (press 3 and request code 3015) or visit us at www.tek.com/mbd/ad?1025

Tektronix®

©1997 Tektronix, Inc. All rights reserved. Tektronix is a registered trademark of Tektronix, Inc.

continued from page 31



© John Wakefield

'Technology confrontation is fine, so long as it doesn't inhibit getting things done.'

balance looks like, what we are doing and why we are doing it," he explains.

When a project is authorized, Kaplan then investigates what outcome he's trying to obtain. "Am I adhering to the design rules I put in place? Will the supplier or partner I'm working with do things differently and, if so, why? I need to know whether the unit cost has dropped or gone up. I must decide how to respond to changes in marketplace dynamics," he says. "Most of our capital programs are signed off during a one-hour technical walk-through. Only the really big ones go to the chairman or the board for final approval," he explains.

Kaplan's responsibilities are similar to those of a small business owner. In rapidly growing companies, these individuals are powerhouses of knowledge who gather their support staff around them and paint a vivid picture of the organization's future. They know what they are and what they are doing, and they instill their philosophy in their colleagues, by telling them where the company is headed, what the product is and what it means to their customers. Usually, these companies reach their full potential only a short time after startup.

Filling a similar role in a giant corporation such as Sprint requires a tremendous amount of cooperation. "To get this level of support, I use a collaboration network consisting of 'scull' sessions that last two to three hours," Kaplan explains. "When there's a technology topic I want to explore, I get a dozen of the best minds in Sprint around a table. I listen, I moderate, I participate. Technical people who disagree are impassioned in their stances, so my job as CTO is to rationalize their differences. I have to know if these are semantics or if there are real issues to be resolved. If they're real, I must understand [their implications] and guide everyone in a single direction without getting into a win-lose situation. My rule is usually to say, 'Hey—maybe we're all really talking about the same thing.' Technology confrontation is fine, so long as it doesn't inhibit getting things done."

For example, Kaplan brought in people from all over the company to create a new set of dynamics when debating Internet Protocol (IP) and ATM applications. "By urging them to support [their] convictions, I was able to reach a better and a faster answer," he says.

HOW TECHNOLOGY EMERGES

The danger for major interexchange carriers (IXCs) is that they often expect their account executives to sell new technology with little or no training. "We are at a time where everything is part of an integrated network and we have to understand the line of demarcation between a voice service and a data service," Kaplan contends. "Our portfolio contains local, long distance, international, wireline and wireless, voice and data, video, and multimedia. If I'm a customer, the last thing I want is different people showing up at the same time. Selling Sprint's offerings must be part of a seamless information process."

How technology emerges in the marketplace is an issue squarely within Kaplan's domain. "Enabling technologies on the leading edge result in an entire re-engineering paradigm," he says. "Sonet did that at the transport level and ATM at the switching level. You often find yourself far ahead of standards.

"There is no question in my mind that ATM will be the integrating fabric for all services," he asserts. "We need the quality that ATM offers and we need its ability to interoperate on an end-to-end basis. I believe that not only will ATM at the core be meaningful, but that it will reach all subscribers' premises, eventually."

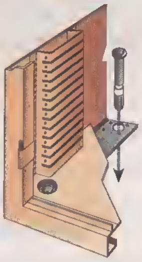
It's sometimes hard to rationalize the two roles of ATM in the network. Kaplan contends that core ATM and edge ATM do two different things: ATM provides feature-richness at the edge, and it provides efficiency in the core. "What I am looking for in the core is not feature functionality; I need efficient network-to-network interfaces," he explains. "I need the cells to go through without worrying if we're converting frames or carrying IP or voice packets.

"Core ATM has to let me get to any destination as quickly as possible, no matter what protocol is involved," Kaplan continues. "The priority is to reach the right destination with complete interoperability. The golden rule is that whoever integrates first, wins. The reason I am bullish on ATM and Sonet

To get a copy of our seismic product catalog, call 919-575-6426

We Make Seismic Cabinets For A Very Powerful Reason.

Now there's a seismic card storage cabinet that meets telephone company requirements for seismically active areas. Ours.



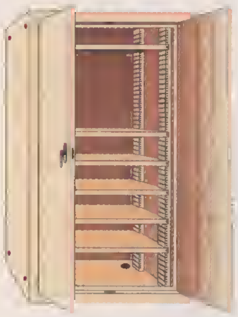
Floor anchors accessible from interior; continuous bead welds add strength.

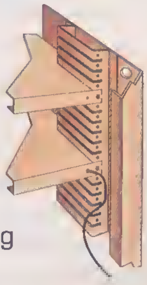
Obviously, if our cabinet meets earthquake requirements, it must be a quality product. Fact is, most of Newton's product line — more than 20,000 enclosures, racks, frames and accessories — meets or exceeds the specifications of both central office equipment manufacturers and telephone companies.

And, in order to meet your specific standards, Newton offers custom products and inspection programs.

Call or write for our pocket catalog or corporate video. And see all the powerful things we can do for you.

Doors feature three-point locks— top, bottom and door to door; side-to-side junctions for connecting multiple cabinets.





Adjustable shelves with grounding assembly.

NEWTON
INSTRUMENT COMPANY, INC.
Made Right When You Need It.

ISO 9001 CERTIFIED Company

BICSI CORPORATE MEMBER

111 East "A" Street, Butner, NC 27509-2426
Phone (919) 575-6426 ▪ Fax (919) 575-4708
Visit Us At COMNET, Booth #3006

Circle 106

is that, once users start talking about integration, I see them putting more of their services to a single provider's network. Therefore, robustness and service consistency vs. rapid service recovery is what it's all about."

THE CHALLENGE: CUSTOMER CONTROL

The major challenge of the telecommunications industry, according to Kaplan, is "to move from the old world to the new world, and make the transition as painless as possible. Our customers are the ones who control capability, so we have to give them what they want when they want it.

"Looking at Sprint's network a year or two down the road, I see total integration of services," he asserts. "We'll have the ability to set up dynamic bandwidth as we need it, when we need it, for any service we need."

This has far-reaching implications for large carriers. "Once you have that ability in place, your cost structure is different," Kaplan says. "When you sell a single service over a single network, that's a high-cost situation. It's not until I can run many applications over a common infrastructure that my cost equation balances.

"Until now, the industry's main role has been to connect specific protocol subscribers anywhere in the network," he continues. "Now, I must allow them to have video collaboration, content hosting, local caching and a dozen other things. In essence, I equip them with the capability to use any media distribution at any bandwidth they need."

Thus, the challenge is no longer basic technology—it's layering services on solutions previously developed. "If I were to summarize it in one word, it would be *integration*—integration of technology, integration of services and integration of applications," Kaplan says. "We're finally getting to a point where you can take some things as a given. For example, I have a Sonet layer, which is a transport layer that works continuously, provides a service consistency and has all the bandwidth I'll ever need."

> 'It's not until I can run many applications over a common infrastructure that my cost equation balances.'

EXTENDING CAPACITY WITH WDM

The latest technology at Sprint is wavelength division multiplexing (WDM), which is like a laser pointer, projecting many different lights down a single-mode fiber, each one carrying gigabits of information. At the other end, these lights are brought back together. In 1999, Sprint's WDM implementation will extend its network's capacity 40 times and, by the end of the decade, by as much as 100 times.

WDM illustrates the relationship between technologies right out of the lab and those that integrate network services and user requirements. "[WDM] allows me almost unlimited scalability, while maintaining network survivability and service consistency," Kaplan says. "I put in channels as I need them, and I don't have to put in the maximum—I can add 16, 32 or whatever. Because WDM enables great scalability on the transport layer, it allows the carriers to avoid their biggest expense, which is the physical fibers."

How can end users get huge bandwidth on a dynamic basis when they need it? On the transport level, users must have the scalability that lets them plug and play over the network, he answers. "That translates to higher bit speeds, and the bandwidth they need is determined by whatever they plug in at the interface," he says. "Until recently, the fastest set of routers in the Internet were running OC-3. Now, they are at OC-12. If ATM switches are OC-12 today and we need OC-48, the quickest way to get there is WDM."

WDM is more cost-effective to assign additional bandwidth than to assign additional fibers. This lets the industry tackle the problem of the final mile that separates the broadband network from narrowband users, according to Kaplan.

"If you look down the road, you'll see network architects working on what they call passive optical solutions," he explains. "These are nothing more than an optical connection to the home. If you have a wavelength right to your home, the bandwidth is only defined by the electronics that you can put on it. The secret is not to string fiber to the doorstep right away (which is prohibitively expensive), but to back it up to an intermediate distribution point that serves a limited number of homes."

EFFECTIVE USE

Thus, the priority for the telecommunications industry is not to develop further technologies, but use existing ones more effectively, according to Kaplan. He believes final-mile connections will be a mix of wireless, satellite and physical (fiber and copper) facilities. "In my opinion, if we don't soon open up and figure out our access strategy, history will pass us by," he observes.

But, how will the access issue finally play out? "There has got to be a carrier that breaks new ground," Kaplan predicts. "Someone must demonstrate a new world of applications that are implementable using existing technology and for which there is a major need.

"At the end of the day, it is society that suffers if this does not happen," he says. "In my opinion, the only way to support end users is to find out what they need and how we can supply this need over the media we have at our disposal. Then we must market, sell, and run with those applications." ■

Contributing editor Alan Stewart is a freelance writer and telecommunications consultant based in Chicago.

HDSL

HAS **COME OF AGE** WITH ADTRAN'S **FIFTH GENERATION**

With age comes wisdom, they say, and ADTRAN's family of fifth generation HDSL products have evolved to a new level of capabilities. Our HDSL products are rich in features that provide safe, cost-effective and efficient solutions for local loop deployment.

ADTRAN is the only source in the industry for HDSL range-extension products that operate on less than -140vdc, are fully MTIE compliant and meet Bellcore Class A voltage specifications. *For more information on how you can deploy the most advanced HDSL solutions available today, contact ADTRAN at 18009ADTRAN or visit our website at www.adtran.com.*

ADTRAN

T1 FRAME RELAY ISDN VOICE DDS SWITCHED 56 HDSL

1 800 9ADTRAN ▪ 901 Explorer Blvd. ▪ P.O. Box 140000 ▪ Huntsville, AL 35814-4000

T6.AD.9712.AMNT

Featuring

- Full NEBS Compliance - (Test Results Available)
- Bellcore GR-1089 Class A3 Compliance for Safe Span Powering
- ANSI T1.101 MTIE Compliance
- Lowest Power Consumption in the Industry
- The Industry's Smallest Remote Unit
- Enhanced Performance Monitoring
- Extensive Diagnostic Support
- Comprehensive Status Indicators
- Extended Temperature Hardening -40° to +70°C
- Easy-to-Use Craft Interface
- Local and Remote Provisioning
- Local and Remote Diagnostics
- System Level Management
- 10-Year Warranty

Circle 107

CHARLES MASON

Killer Apps:

The telemedicine breakthrough

Revenue gains from home health care and other applications should start this year.

IN SOME RURAL AREAS, a person having a heart attack has up to a 90% greater chance of not reaching help alive, compared to someone lucky enough to be near a major city hospital. Emergency or not, rural residents often receive their health care from physicians not familiar with (or who cannot readily access) the latest medical techniques. Indeed, in some parts of the United States, health care is not much above Third World standards, according to government and private research.

Telemedicine has the power to change this.

The use of electronic communication networks to transmit information related to the diagnosis and treatment of medical conditions, telemedicine can provide patients with expert care not regularly available. However, despite some prominent uses in radiography and cardiology, the use of telemedicine has not become as widespread as society expected.

"We see a tremendous amount of products and discussions," says Allen McMillan, president of Insight Research Inc. (Atlanta), a company that provides consulting services to hospitals and other health care providers. "There is a lot of interest and many people, including myself, spend a lot of time and money on this. [But] we have yet to see this become the killer app."

A major problem is that, despite the sophisticated medical equipment used in hospitals for diagnosis, treatment and surgery, many health care professionals still have an anti-technology bent. "Most doctors and nurses, as well as administrators, are not used to using advanced electronic technology," McMillan notes. However, he and others in the field maintain that telemedicine could become a major application for broadband telecommunications service providers during the next couple of years.

DRIVING DEPLOYMENT

The early 1990s brought turmoil to the U.S. health care industry as rising costs, an aging population, misdirected attempts at health care reform, increasing liability insurance costs, and the closure of rural hospitals conspired to create a meltdown in the country's national health care delivery system, according to a report by The Insight Research Corp. (Parsippany, N.J.; not affiliated with the Atlanta-based company). Increased pressure to cut health care costs while improving quality and access finally has prompted the health care industry to focus on technology as a way to achieve its goals, the report states.

Most telemedicine systems in the U.S. are in the trial or evaluation stage, so it's premature to say that market forces are driving deployment. There are various factors and market conditions which have the potential to thrust telemedicine applications into the forefront, according to the Parsippany-based Insight. Of course, on the other side of the equation, a number of important issues will need to be addressed before telemedicine can be fully implemented (see box).

Factors and market conditions for deployment of telemedicine

Drivers:

- Reduction in travel time and related improvements in productivity of health-care professionals.
- Ability to provide service to areas not otherwise covered, increasing access to health care by rural residents.
- Physician and hospital revenues increase from expanded patient list due to ability to serve new markets.
- Physical home health care expenses can be saved, in many cases.

Issues to resolve:

- State regulations limit practicing medicine to within state only.
- Lack of policies for reimbursing providers offering telemedicine-enabled services.
- Interoperability standards and protocols must be reached by telecommunications equipment and medical device manufacturers.
- Physicians must become willing to use the new technology.
- Health-care budget cuts could affect deployment.
- Deployment plans will need to include costs of transmission and equipment.
- Equipment and facilities must be made widely available.

Source: The Insight Research Corp.

One factor is reducing distance. Telemedicine applications can increase a provider's efficiency and perhaps reduce health-care costs by eliminating travel time between sites.

Telemedicine also can be employed as a partial replacement for personal home health care visits. Through the use of two-way, interactive video, it becomes possible for the health care professional to be "with" a patient every time he or she takes a pill or self-administers an injection.

Additionally, when telemedicine-based consultations become a routine paying proposition, the application becomes a source of revenue to consulting medical providers.

There is a "down" side, Insight Research notes. Telemedicine crosses state lines; however, state regulations limit the licensing of health care professionals as in-state practitioners only. Moreover, agreements must be reached on standards, protocols and interoperability issues for not only telecommunications vendors but for medical equipment manufacturers as well. Finally, the willingness of physicians to participate in such applications, the effects of federal, state and organizational budget-cutting on programs, and the cost of transmission and equipment will need to be resolved.

The Insight Research Corp. estimates that the total revenue boon to telecommunications carriers from telemedicine and health information networks will occur during a four-year window: 1998 through 2001. This growth will be spurred by the implementation of telemedicine-based home health care and health information network technologies.

Telecom service providers stand to gain $2 billion in revenues from telemedicine applications, according to the New Jersey-based Insight. At first glance, this seems relatively insignificant, given the fact that local exchange carriers (LECs) and interexchange carriers (IXCs) stand to make a combined $202 billion in 2001, according to researchers. However, the telemedicine projection does not include revenues from equipment sales, and fees for systems integration, network management or transactions, all of which represent additional opportunities for telecommunications service providers in the health care market. It undoubtedly will be more lucrative than the commodity-like bandwidth market.

The biggest stimulants for telemedicine networks appear to be in health information networks (HINs), which share billing and other health information, and in home health care. Carriers such as Pacific Bell (San Francisco), Ameritech (Chicago) and some of the IXCs appear to be in the best positions to take advantage of the HIN opportunity because of their early involvement in the telemedicine sector.

Home health care via telemedicine is still in its infancy. Carriers still need to work closely with equipment makers, health care providers and government agencies to work out issues in home health care and to ensure that the needed infrastructure is in place—for if the LECs fail to do so, the cable TV (CATV) industry could take advantage of the situation. CATV networks will need two-way capability to provide the interactive video capability required for many home health care applications, and this is an area where CATV providers are making substantial investments. ■

CHARLES MASON

Killer Apps:

Up-ending the bottleneck

Interoperability pacts open the way for cable modems.

THE MARKET for cable modems is poised to take off in 1998. At least that's what vendors, carriers and some analysts predict. Manufacturers are ready to produce these modems in quantity, and CATV operators have made it known that they want to tap the Internet access market.

"We are on the verge of having real momentum," says Jacob Tanz, vice president of North American sales and marketing for Israel-based Libit Signal Processing Ltd. Cooperation on interoperability issues have advanced the business significantly, he says: "Interoperability helps reduce overall cable modem costs for equipment makers and consumers. In addition, technology developments are allowing cable modem manufacturers to offer reliable and robust products at low cost to meet the high-volume demands of the industry."

Iwami Asakawa, senior vice president of Toshiba America (Irvine, Calif.), agrees: "The cable modem market is poised for rapid growth." Toshiba is positioning to be a major player, along with Motorola, Fujitsu and several others.

Research firm Forward Concepts (Tempe, Ariz.) projects a mass market for cable modems in the U.S.—more than 7 million users by 2002. The number of cable modem users around the world will increase from 4.4 million in 2000 to more than 19 million by 2005, according to Ovum (Boston), a technology research and consulting company.

"The convergence of three traditionally separate industries—broadcasting, telecommunications and computing—has meant that a range of organizations are now looking to define their place in multimedia information, not least the cable companies," says John Davison, senior consultant at Ovum. "The cable industry has woken up [sic] after a long history of simply distributing broadcast entertainment.

"The explosive growth of the Internet has created unprecedented awareness and demand for data networking among business and home users," Davison continues. "Optimized for carrying voice traffic, however, the world's telecommunications networks are struggling with bottlenecks of information flow, particularly at the local loop. Cable modems have the potential to turn traditional bandwidth bottlenecks upside down."

While the Internet remains the main application CATV operators aim to support with early cable modem implementations, many providers plan more sophisticated, real-time services, particularly to businesses. Telecommuting, for example, is a major growth area; the requirements of telecommuters are more demanding than those of the average residential user, Ovum reports.

BRINGING THE COSTS DOWN

Driving widespread adoption of cable modems is the reduction in manufacturing costs and the drive toward standardization. Heavy hitters are lining up to support the technology. Intel Corp. (Santa Clara, Calif.), for example, has invested in @Home Network; the two will develop external cable modems using Universal Serial Bus (USB) and IEEE 1394 technologies for plug-and-play connectivity. The two also plan to work on Internet protocol (IP) telephony, including transmission of voice, video, teleconferencing and videoconferencing (see related story, page 88).

Design specifications for cable modems are scheduled to be available in the first half of 1998. Last year, five cable modem manufacturers provided system submissions to the CATV industry's data interface specification process, so it's likely there will be interoperable cable modems available in first quarter. The Cable Television Laboratories Inc. (CableLabs; Louisville, Colo.) research and development consortium, Rogers Cablesystems Ltd. (Toronto), Continental Cablevision (Denver), and CableLabs' Multimedia Cable Network Systems (MCNS) working group members—Tele-Communications Inc. (TCI; Englewood, Colo.), Time Warner Cable (Stamford, Conn.), Comcast (Philadelphia) and Cox Communications (Atlanta)—will incorporate key intellectual property, as necessary, from some of these companies in the open, nonproprietary specification.

The CyberSURFR is one of several cable modems coming into the Internet access market.

Motorola

The heaviest hitters in the industry are lining up to support cable modem technology.

A three-phase, interface-specification-development process, in place since November, provides multiple sources of interoperable modem products, resulting in competitive, lower prices. This process gives consumers a wide selection of product choices, since any supplier can build to industry specs.

In March 1997, CableLabs' Data Over Cable Service Interface Specification (DOCSIS) working group finalized and began distributing the radio frequency (RF) spec, which allows suppliers to build interoperable, high-speed cable modems. The working group was comprised of representatives from Comcast, Continental Cablevision, Cox Communications, Rogers Cable Systems, Time Warner, TCI and CableLabs. CableLabs issued a request for proposal for the fabrication and delivery of a limited number of prototype modems to evaluate interoperability and compliance. The interface spec calls for delivering data down the cable at typical rates of 27 Mbps to 38 Mbps and upstream at rates of 320 kbps to 10 Mbps.

In November, CableLabs and its members established a path of certification so cable modem suppliers can obtain "interoperability seals" for high-speed data delivery devices based on the MCNS/DOCSIS spec. This process provides suppliers with a fast, market-oriented method for attaining CATV industry acknowledgment of DOCSIS compliance, says Richard Green, president and CEO of CableLabs.

The plan's central element is a CATV operator-staffed certification board that would control issuance of "interoperability seals" and compliance with the process. The seal gives CATV operators a way to ensure that equipment complies and operates with DOCSIS products made by other vendors.

"We fully expect that cooperation to be amplified as we near the successful resolution of compliance and interoperability issues and start to see volume shipping of first generation, field-grade DOCSIS equipment," Green says.

David Fellows, chief technology officer for MediaOne (Denver), says verification, certification, field evaluation and commercialization form the centerpiece of the industry's drive to make cable modems ubiquitous. "Certification is the next critical step," he says.

In December, the first field trial of cable modem and termination equipment built to the MCNS/DOCSIS specs became operational in Litchfield, Conn.: Time Warner's Road Runner Service. Toshiba's MCNS cable modems deployed in Litchfield are the first to be delivered to trial households under MCNS/DOCSIS.

The modems operate at nearly 40 Mbps downstream, using 64 quadrature amplitude modulation (QAM) *and* 256 QAM modulation in a standard 6 MHz channel. Upstream data rates are up to 10 Mbps using quadrature phase shift keying (QPSK), a digital frequency modulation technique for coax-based data, and 16 QAM modulation. Time Warner installed the Toshiba MCNS Cable Interface Gateway at the Litchfield system head end and established data connectivity over the hybrid fiber-coax (HFC) network to MCNS cable modems in homes. The modem connects to the customer's PC using a 10 Base-T interface; access to the Internet is through the Road Runner network.

"We are the first company on record to roll this technology over an [HFC] cable system to consumers in their homes," says Mario Vecchi, chief technical officer and senior vice president of technology for Road Runner. With the introduction of multivendor-interoperable cable modem technology based on MCNS/DOCSIS specs, the market "will accelerate" in 1998, he adds. ■

Does your team have what it takes to pass the ATM test?

Circle 108

FLUKE®

If you're checking out ATM testers, here's what's new: Fluke now has a full line of rugged, handheld ATM analyzers that deliver more value for less money and actually help improve tech staff performance.

In fact, Fluke testers make ATM service commissioning and troubleshooting a piece of cake—even for the less experienced tech. That's because these units are so easy to use. And because they let you put reliable benchtop testing power into the hands of every crew member.

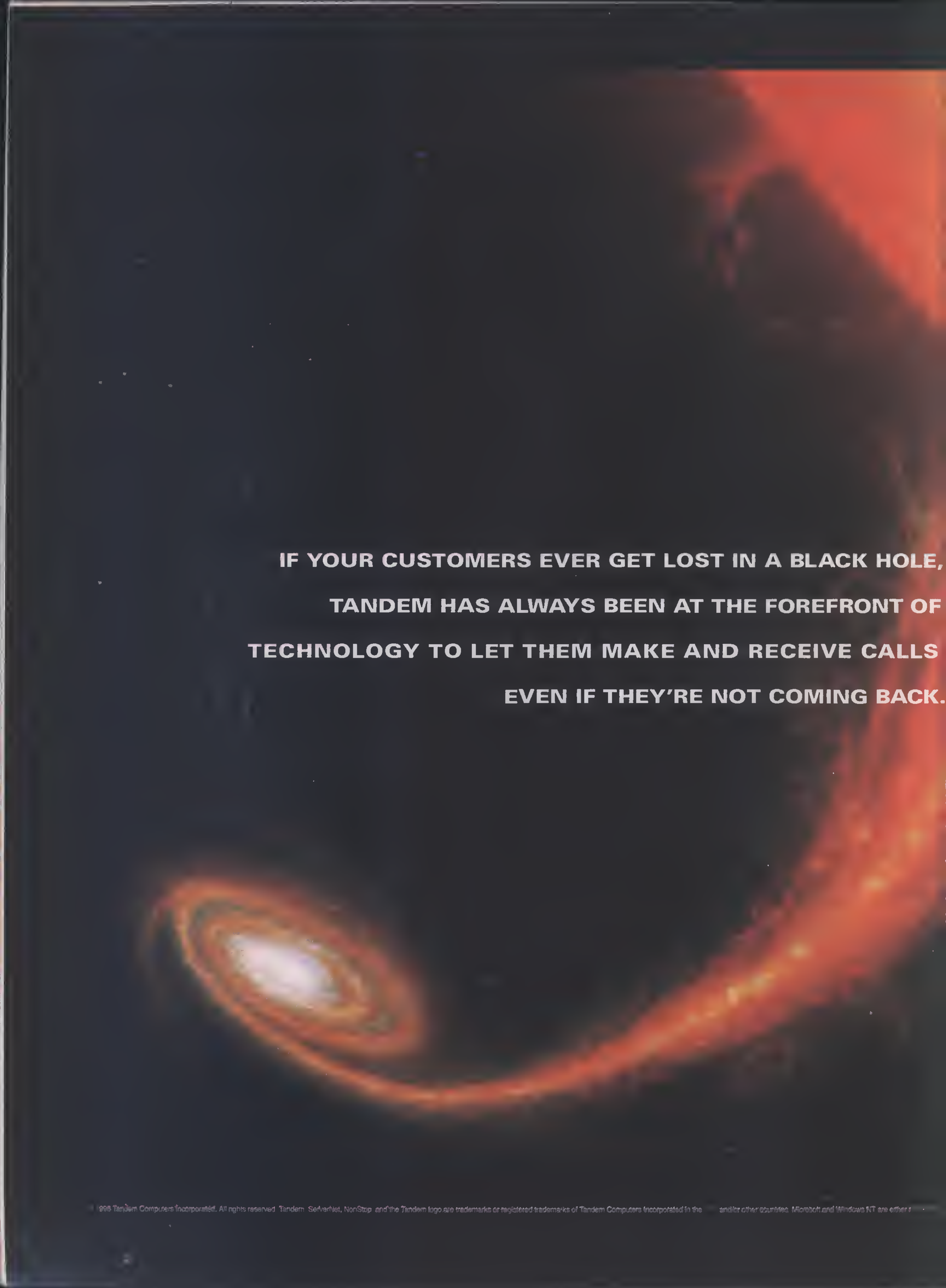
Designed for DS1, DS3, E1, E3, and OC3/STM1 networks, Fluke testers are packed with features that are right on target. Like an Auto Discovery mode for locating ATM activity. Automatic physical layer and ATM layer qualification. Traffic contract emulation and traffic monitoring. QoS analysis. And test storage and printing capabilities.

For more information on how to pass the ATM test with flying colors, call **1-800-44-FLUKE** now. We've got the answers.

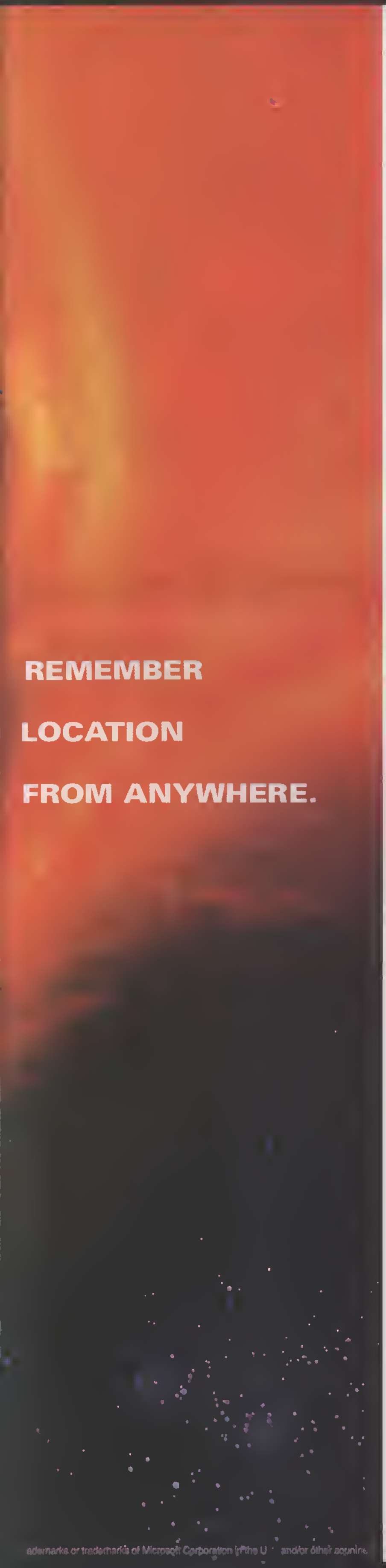
Fluke. *Keeping your world up and running.*

FREE. Go to **www.fluke.com/nettools/atmtest/** and take our ATM test. We'll send you a surprising little reward.

©1997 Fluke Corporation. U.S. (800) 44-FLUKE.
Fax back (800) FLUKE-FAX. Canada (905) 890-7600.
Europe (31 40) 2 678 200. Other countries (425) 356-5500.
www.fluke.com/nettools All rights reserved. Ad no. 01017


IF YOUR CUSTOMERS EVER GET LOST IN A BLACK HOLE,
TANDEM HAS ALWAYS BEEN AT THE FOREFRONT OF
TECHNOLOGY TO LET THEM MAKE AND RECEIVE CALLS
EVEN IF THEY'RE NOT COMING BACK.

998 Tandem Computers Incorporated. All rights reserved. Tandem, ServerNet, NonStop and the Tandem logo are trademarks or registered trademarks of Tandem Computers Incorporated in the and/or other countries. Microsoft and Windows NT are either r



When you're the leader, you can't help but think ahead. From leading-edge off-switch HLR solutions that push wireless further, to our ServerNet™ clustering technology, to our Windows NT® Server-based intelligent network portfolio, Tandem helps over 200 telecommunications companies around the world stay ahead. By providing technology that is unmatched in innovation and effectiveness, Tandem is taking telecommunications full speed into the next millennium. Wherever it happens to lead. Questions? Visit us at www.tandem.com or call 1-800-NONSTOP, ext. 8024.

TANDEM®
a Compaq company

Circle 109

ademarks or trademarks of Microsoft Corporation in the U.S. and/or other countries.

In a country of 250 million, is it *possible* to have a personal relationship with *everyone?*

Whether you want to talk with an audience on a nationwide scale, a microtarget of just hundreds, or anything in between, nothing can match the one-to-one communications power of Direct Mail.

Because Direct Mail lets you speak with each and every one of your best prospects. It lets you establish an ongoing dialogue with them. So you can communicate the very relevant, very individualized benefits of your brand.

DIRECT MAIL DELIVERS℠

Your customers get to know you, and you can respond to their needs. This special relationship builds loyalty and repeat sales. Bottom line, your bottom line looks even better.

For a free kit on how Direct Mail can help build business, call 1-800-THE-USPS, ext. 2044.

UNITED STATES
POSTAL SERVICE

TI 65. © 1998 United States Postal Service.

Learn how
Direct Mail can
deliver greater
profits for
your business.

K

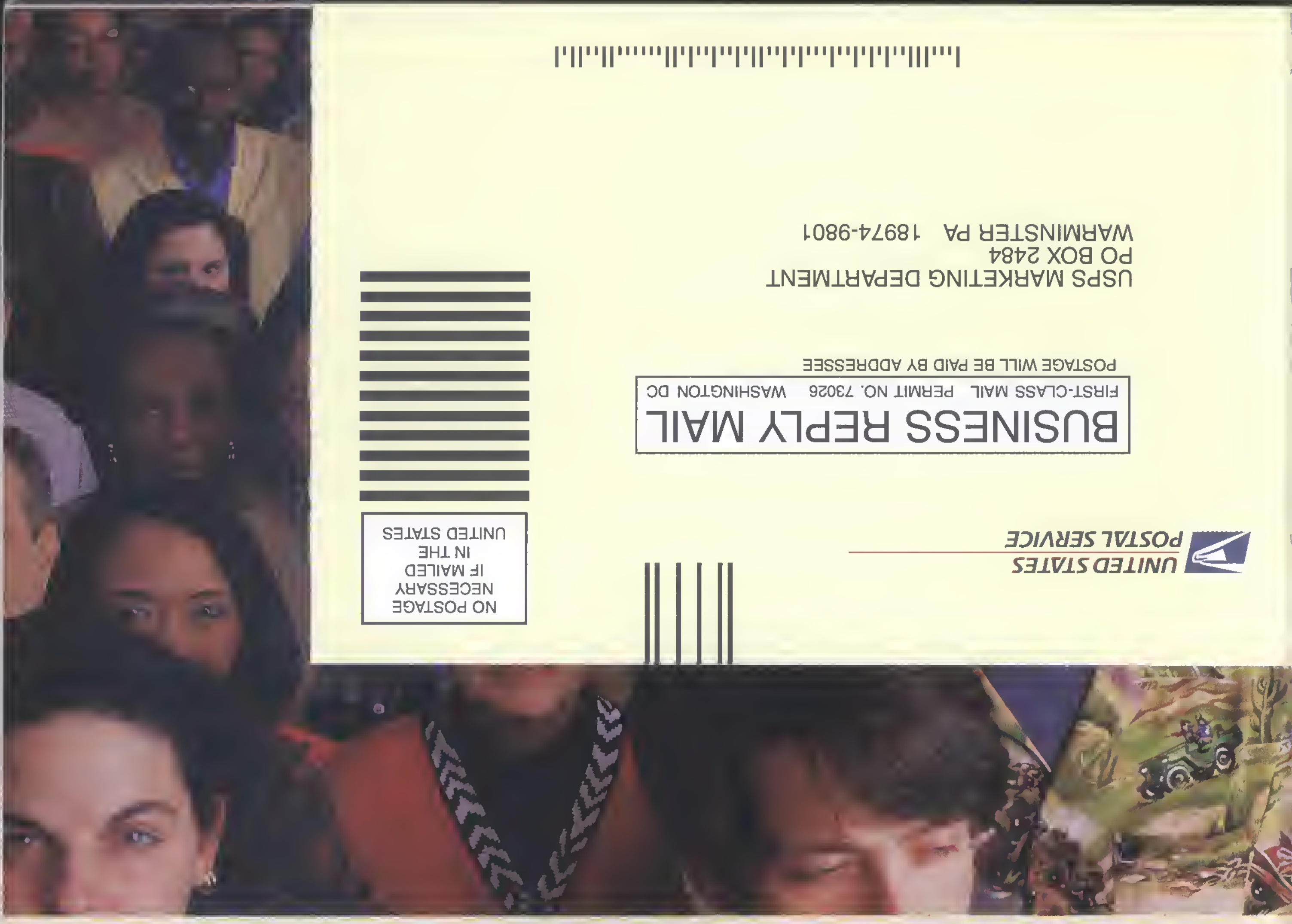
TY

ork

THE IMPACT OF CHANGING TECHNOLOGIES

3 OF A FIVE-PART SERIES

SUPPLEMENT TO
America's Network



BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 73026 WASHINGTON DC

POSTAGE WILL BE PAID BY ADDRESSEE

USPS MARKETING DEPARTMENT
PO BOX 2484
WARMINSTER PA 18974-9801

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

UNITED STATES
POSTAL SERVICE

In a country of 250 million, is it *possible* to have a personal relationship with *everyone?*

Whether you want to talk with an audience on a nationwide scale, a microtarget of just hundreds, or anything in between, nothing can match the one-to-one communications power of Direct Mail.

Because Direct Mail lets you speak with each and every one of your best prospects. It lets you establish an ongoing dialogue with them. So you can communicate the very relevant, very individualized benefits of your brand.

DIRECT MAIL DELIVERS™

Your customers get to know you, and you can respond to their needs. This special relationship builds loyalty and repeat sales. Bottom line, your bottom line looks even better.

For a free kit on how Direct Mail can help build business, call 1-800-THE-USPS, ext. 2044.

UNITED STATES
POSTAL SERVICE

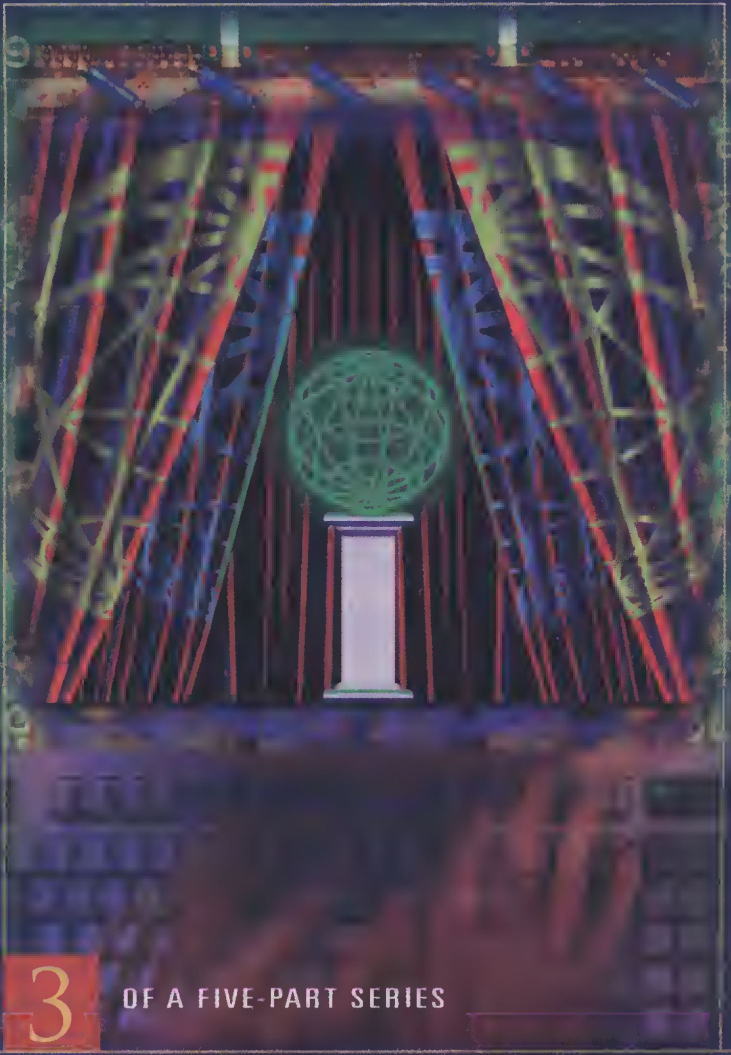
TI 65. © 1998 United States Postal Service.

SPECIAL ASSIGNMENT

NETWORK RELIABILITY

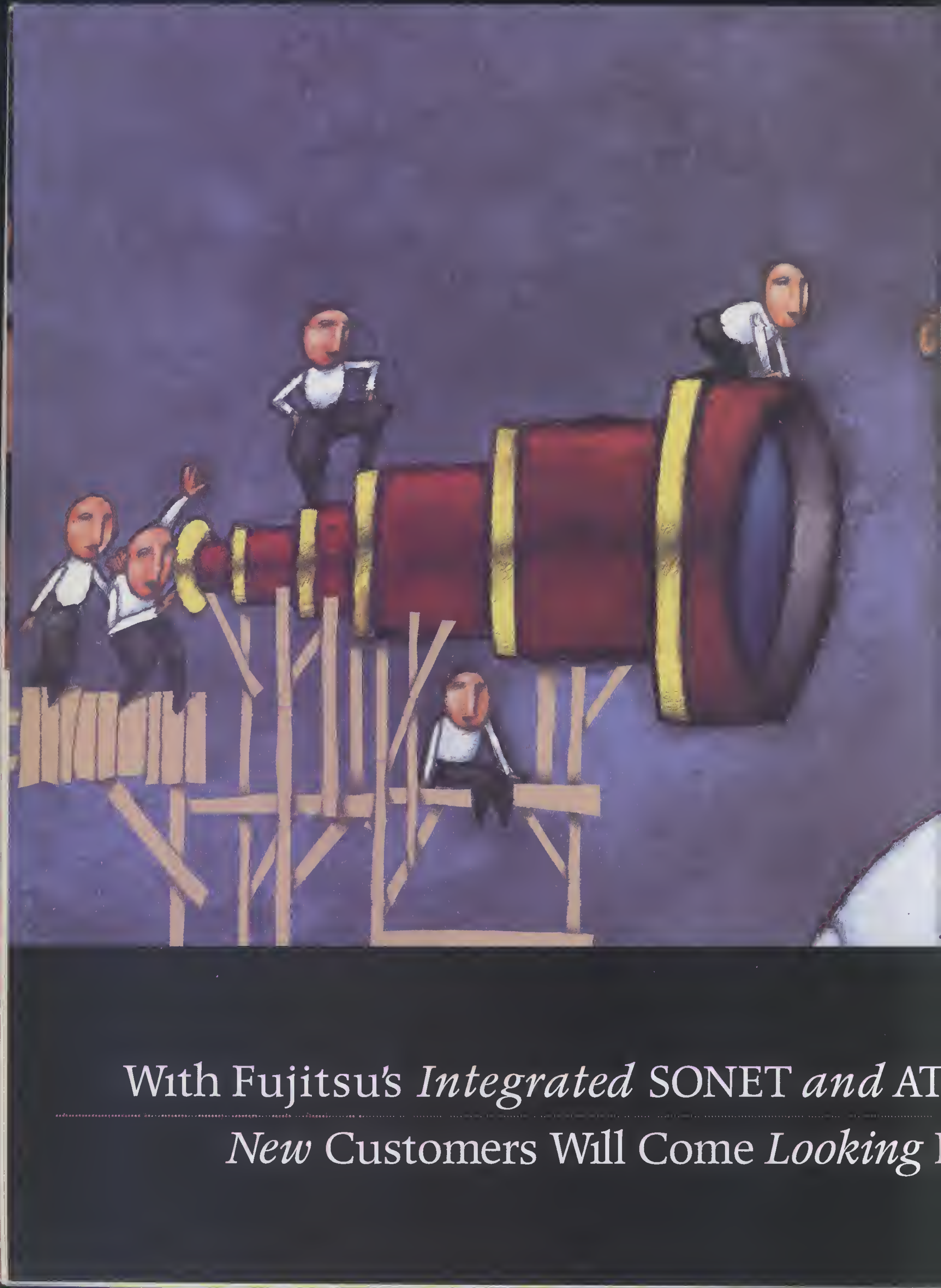
The Health And Safety Of The Public Network

THE IMPACT OF CHANGING TECHNOLOGIES



3 OF A FIVE-PART SERIES

SUPPLEMENT TO
America's
Network


With Fujitsu's *Integrated* SONET *and* AT
New Customers Will Come *Looking*

M Solutions,

or You.

Scope Out Our Revenue-Building Services and Network Solutions.

Fujitsu is a broadband resource with a broad range of network service solutions. With our integrated ATM-over-SONET capabilities, you can offer network services that will have new customers looking your way. LAN interconnection, cell relay, high-speed Internet access, high-capacity DS1/3 circuits, survivable DS0-based services and more. All designed with your profitability in mind.

Looking Out for Your Best Interests.

Fujitsu was the first supplier to increase the ease and efficiency of network management by offering full 7-layer OSI capabilities across our entire product line. Now we're the first to integrate ATM traffic into a SONET transport network to give you optimal bandwidth utilization, lower network management costs and maximized network flexibility as you grow into the next century.

The Experience and Strength to Keep You and Your Customers Covered.

Fujitsu is the largest local exchange network supplier of SONET technology in North America, with over 60,000 flexible, reliable and easily upgradable systems in operation. And more are being created every day. After all, our systems offer all the optimal bandwidth utilization and survivability Fujitsu SONET networks are known for. Each system includes Fujitsu networking features like software-downloadable product enhancements and remote memory backup for network restoration. From industry-standard OC-192 to survivable DS0's, Fujitsu has your network covered with the greatest interoperability anywhere.

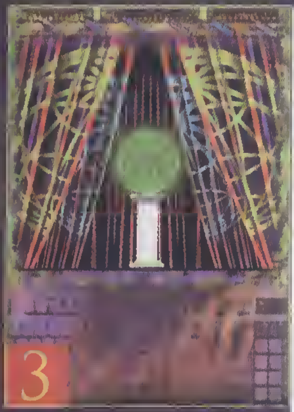
We'll Keep an Eye Out for You.

Call on the company that has the expertise, the service support and the experience to help you grow your network. Plus services to help you design applications that new customers will want. To find out more about our ATM-over-SONET solutions, call Fujitsu Network Communications, Inc. at 1-800-777-FAST or e-mail us at fast@fujitsu-fnc.com.

FUJITSU

Building Networks
that
Build Your Business.

www.fnc.fujitsu.com



NETWORK RELIABILITY

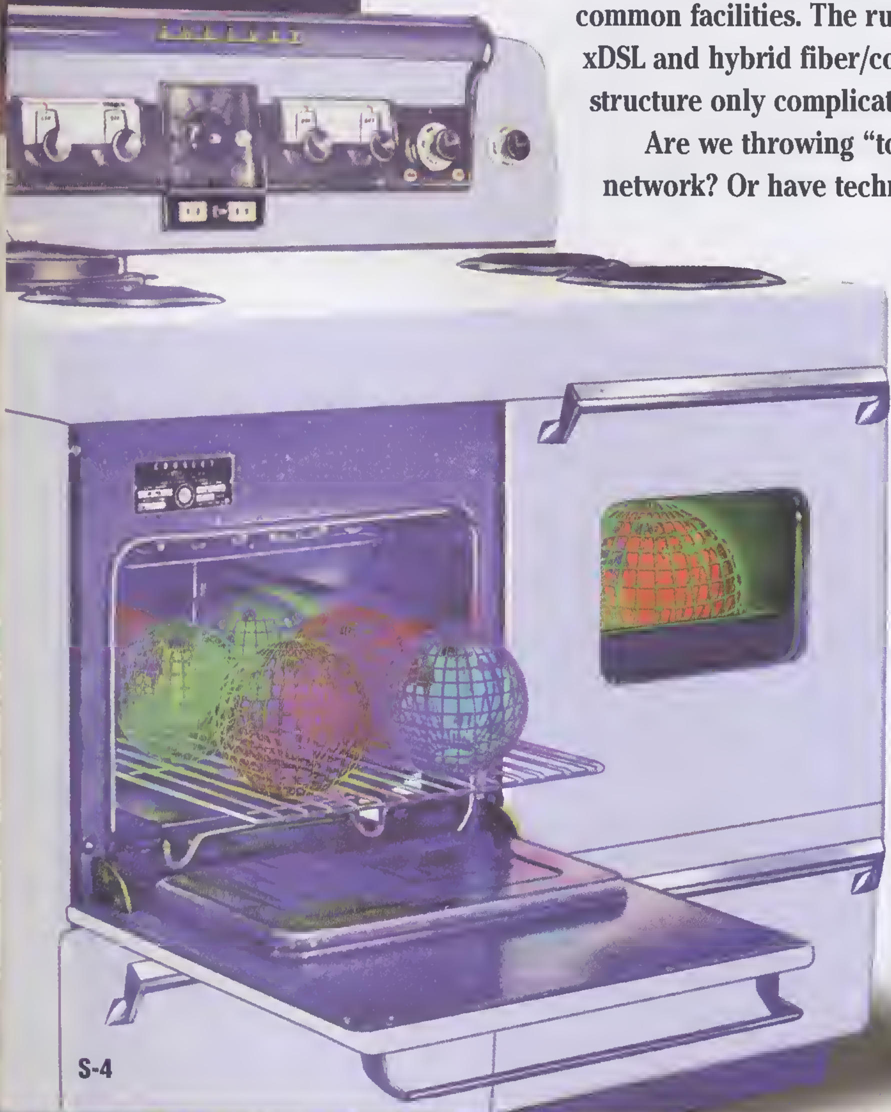
The Melting Pot

How can service providers introduce major new technologies and services and, at the same time, keep the public network reliable? That's the question posed by the third installment, "The Impact of Changing Technologies," of our series, The Health and Safety of the Public Network. (Chapters 1 and 2 were published in Nov. 15 and Dec. 15, respectively. The series runs through March 15.)

Technologies such as Sonet and ATM are enabling new broadband services to accompany the existing narrowband services over common facilities. The rush to provision "mid-band" services via xDSL and hybrid fiber/coax technologies over the same network structure only complicates the melting pot.

Are we throwing "too much" technology too fast at today's network? Or have technological advances—such as optical fiber and self-healing rings—worked to further ensure network reliability?

The articles in this chapter profile how technologies can indeed be used as tools to ensure reliability, if they're implemented and maintained properly. We'll explore how the Advanced Intelligent Network (AIN), with independently developed software management and control tools, can aid the reliability quest. Finally, we'll take a hard look at the performance of the wireless industry, and the special technical and financial difficulties faced by cellular and personal communications services carriers. ■

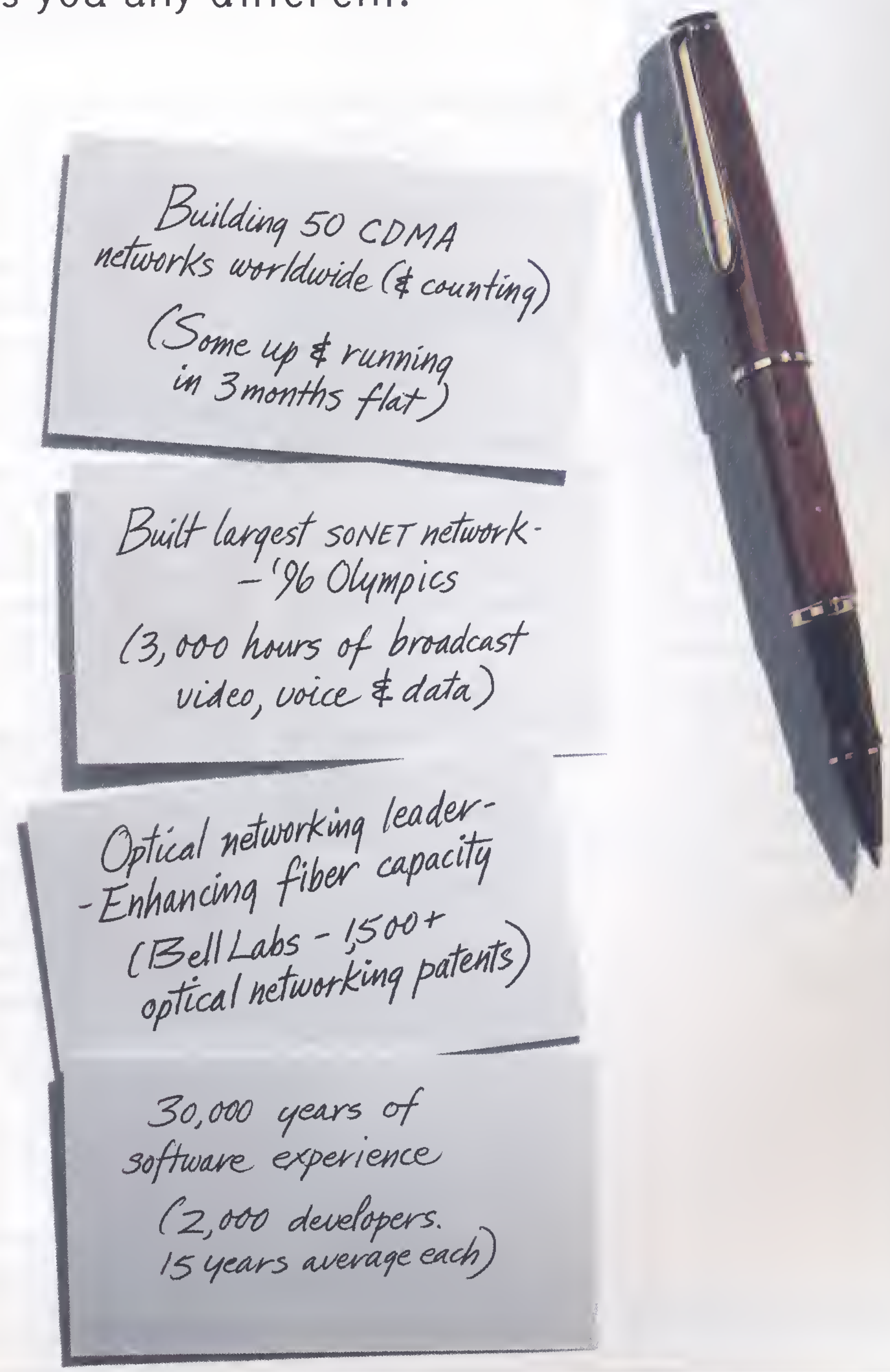


"Everyone tells me

they know their way around

networks.

What makes you any different?"



Building 50 CDMA networks worldwide (& counting)

(Some up & running in 3 months flat)

Built largest SONET network - '96 Olympics

(3,000 hours of broadcast video, voice & data)

Optical networking leader - Enhancing fiber capacity

(Bell Labs - 1,500+ optical networking patents)

30,000 years of software experience

(2,000 developers. 15 years average each)

©1997 Lucent Technologies

We know networks.
Every twist.
Every turn.™

A Double-Edged Sword

New technology can bring enormous reliability benefits to the network, but it also can do a considerable amount of harm.

By Shira Levine

Senior editor of *America's Network*

Twenty-one years ago, AT&T Bell Labs scientists culminated over a decade of work with brand-new fiber optic technology, installing the world's first lightwave system in Chicago—1.5 miles of glass fibers running under the city's streets carrying the equivalent of 672 voice channels.

Fast forward to 1998. After a hundredfold decrease in the cost of fiber from 1980 to 1985 alone, every major service provider—from local exchange carriers (LECs) to interexchange carriers (IXCs) to cable television (CATV) providers—have installed fiber to various extents in their networks, most commonly in the form of rings. As far as reliability experts are concerned, this combination of medium and architecture has contributed more to the overall reliability of the public network than any other factor.

"The advent of fiber optic systems has created an opportunity for us to have an extremely reliable network with the capability to aggregate a large amount of traffic," says Dwight Grimm, manager of on-line support transport for GTE Telephone Operations (Stamford, Conn.). "Before the architecture of the self-healing ring network was available to us, things like outages, network degradation, loss of a portion of our capacity were all much more common."

Fiber is inherently more reliable than its old copper counterpart. "It's basically a very high bandwidth medium for transmission, that is pretty impervious to the elements, with very low loss and far fewer electronics on the transmission path," says Lou Scerbo, senior director of network integration at Bellcore (Morristown, N.J.). "In most transmission systems in the past, problems came from electronics such as amplifiers and multiplexers, but those items have been eliminated because of the low transmission losses associated with fiber optics."

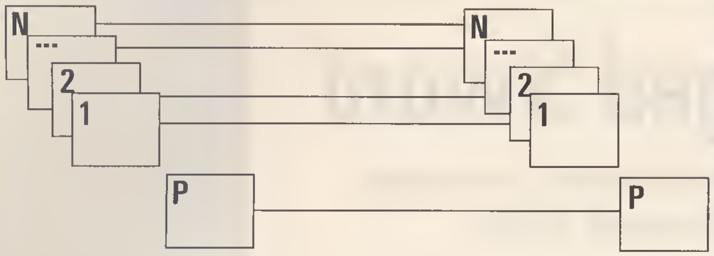
> "In most transmission systems in the past, problems came from electronics such as amplifiers and multiplexers, but those items have been eliminated because of the low transmission losses associated with fiber optics
>
> Lou Scerbo, Bellcore

Ringing out network failures

When lightwave systems were first deployed on a large scale in the mid-1980s, they generally used "one plus n" protection schemes, says Bill Gartner, vice president of research and development for Lucent Technologies' optical network business (Murray Hill, N.J.). Carriers allocated one protection line for a given number of service lines as a way to guard against equipment failure. Over time, the reliability of the equipment improved, but service outages due to cable cuts remained high, because service providers tended to put both the service and the protection fibers in a single sheath, Gartner says.

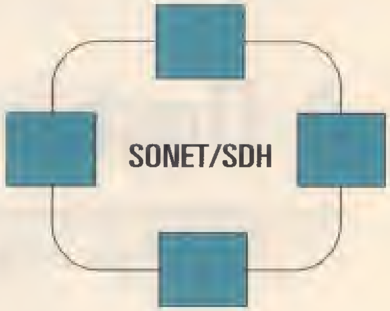
Hence, fiber rings were born. Path-switched rings, typically deployed in access

Optical Networking: Protection Evolution



1980's vintage highwave: 1xN equipment protection

Source: Lucent Technologies



Sonet/SDH: BLSR for equipment and facility protection

networks, is the simplest ring format, in which traffic entering the ring is bridged, or replicated for delivery both ways around the ring, and the destination point chooses the better quality signal. Bi-directional line-switched rings, generally used in backbone networks, are available in two formats:

- Two-fiber, which shares a single pair of fibers for both service and protection; and
- Four-fiber, which has two separate fiber pairs for service and protection.

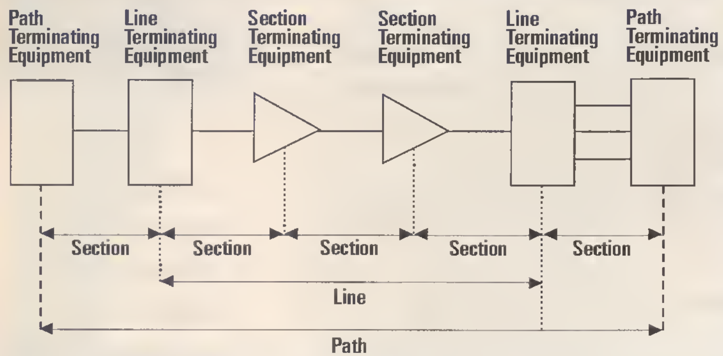
The result is a tradeoff, Gartner says. In the "one plus n" protection scheme, the network was inherently less reliable, but was also more efficient—if a service provider had one protection line for every 10 service lines, then only 10% of its network was kept unused in the event of a failure. With the ring architecture, on the other hand, 50% of the network's capacity is tied up for protection purposes.

"Rings are very inefficient and very costly from a bandwidth perspective," Gartner says. "You're really compromising capacity for reliability."

Nevertheless, carriers are more than willing to make that compromise, trading capacity for more solid assurances against a major network failure. Sychronous optical network (Sonet) technology boosts reliability further by maximizing the rings' potential, particularly in the event of a traffic rerouting. Because a Sonet frame has more overhead than other transmission systems, it can carry the "handshaking" information necessary for rerouting to take place, says Sam Sigarto, director of broadband network architecture at SBC Communications (San Antonio).

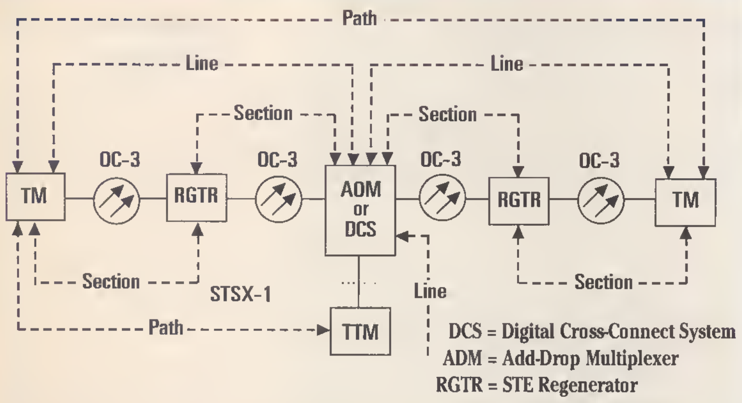
"Because Sonet has room in its overhead structure, it made the self-healing ring architecture possible," Sigarto says. "Sonet enables fiber rings to happen

Simplified diagram of Sonet Section, Line and Path definitions

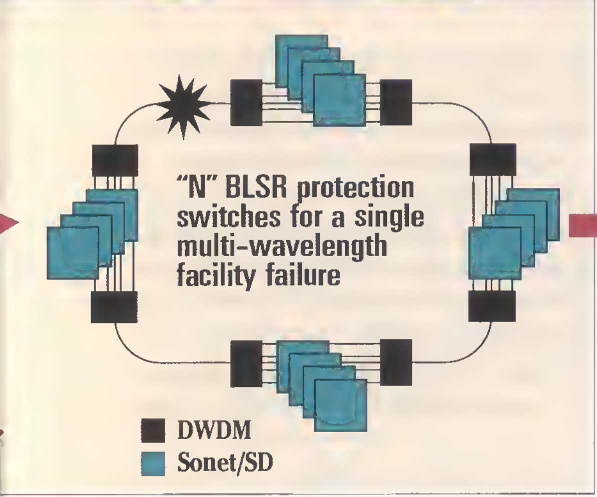

Path Terminating Equipment
Line Terminating Equipment
Section Terminating Equipment
Section Terminating Equipment
Line Terminating Equipment
Path Terminating Equipment
Section
Section
Section
Section
Section
Line
Path

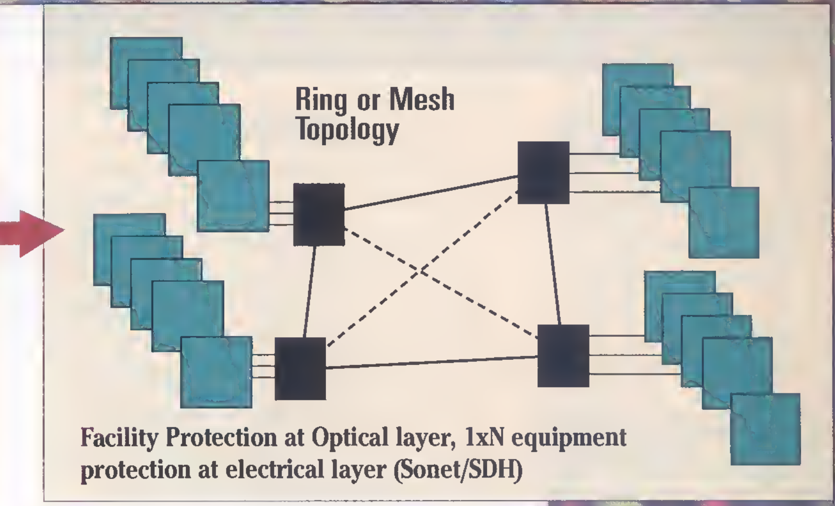
Source:DSC Communications

Sonet Section, Line and Path definitions



Source: DSC Communications


"N" BLSR protection switches for a single multi-wavelength facility failure
■ DWDM
■ Sonet/SD



Facility Protection at Optical layer, 1xN equipment protection at electrical layer (Sonet/SDH)

faster by having the overhead mechanism to carry information for re-routing."

The Sonet overhead is divided into three components:

· Section overhead, which contains the information required for the section elements, or repeaters;

· Line overhead, which contains the information required between line termination equipment such as add-drop terminals; and

· Path overhead, which is assigned to and transported with the payload along the transmission path until the payload is demultiplexed.

The advantage to this structure is that it allows a network management center to do end-to-end performance monitoring of a data signal across a Sonet network, says Scott Messinger, product manager in the access systems group at DSC Communications' Petaluma, Calif., operation.

"Typically, once a signal gets on the Sonet highway, it's processed by the path overhead, the section overhead and the line overhead," Messinger says. "That allows the network management system to be able to look at each of those different categories as the signal makes its way through the network to determine its integrity. Sonet lets you get down to that level of granularity."

The result is that if a service fails, the network administrator can narrow the problem down to the line and then the section where the problem occurred, for easy troubleshooting. Network visibility also means that the network operator can do more preventive maintenance, because subtle problems such as signal degradation can be tracked and resolved before a more serious problem occurs.

"Because Sonet provides a continuous format from an administrative point of view, it gives a superior means of localizing a fault, detecting it and resolving it," Messinger says. "It's inherently easier to manage than asynchronous multiplexers."

Putting the squeeze on Sonet

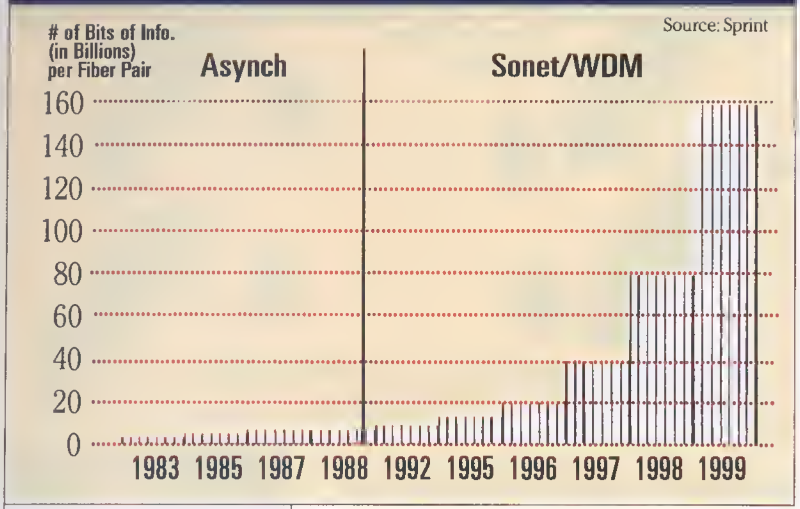
In recent years, equipment vendors have developed a way to take advantage of Sonet's reliability and manageability while addressing the issue of bandwidth inefficiency. Wavelength division multiplexing (WDM) technology increases the capacity of an optical fiber by transmitting the signal at different wavelengths through that single fiber. The result is that carriers can milk as much capacity out of their existing fiber rings as possible, says Denny Bilter, director of marketing at Ciena (Linthicum, Md).

"A carrier that is running out of capacity on its fiber has three options," Bilter says. "It can lay new fiber, which is the most expensive option. It can put in higher-speed Sonet transport products, but often the fiber already in the ground isn't optimized to run at higher speeds like OC-192 and there are a lot of technical things to correct, such as dispersion compensation, which can also wind up being costly. The third option is to put in WDM."

"The fewer number of devices in the network, the more reliability is enhanced"

—Tom McDermott, Alcatel Network Systems

CAPACITY OF ONE FIBER PAIR



Source: Sprint

> "Voice networks require fixed bandwidth. Data relies on more statistical basis, as opposed to a pure dedicated bandwidth basis. It varies, and requires a certain amount of flexibility."
>
> —George Foley, Lucent Technologies

At the very least, WDM doesn't decrease network reliability; engineered correctly, it can actually improve it. A four-fiber bidirectional line-switched ring traditionally allocated two fibers for service and two for protection. With WDM, however, a carrier can choose the level of protection it wants and allocate channels, or wavelengths, accordingly, says Marty Kaplan, chief technology officer at Sprint (Overland Park, Kan.).

"I still have just four fibers, but instead of physically backing up one fiber with another, I can back it up logically with a [WDM] channel," Kaplan says. "I'm using electronics in lieu of physical fibers."

Traffic running on that ring, therefore, receives at least the same level of protection as it would without WDM. However, by installing WDM, carriers can reduce the risk of network failure by reducing equipment in the network, says Tom McDermott, vice president and chief technical systems at Alcatel Network Systems (Richardson, Texas).

"Coupled with WDM is the use of optical amplifiers, which in many cases replace the electronic regenerators in the outside fiber plant," McDermott says. "With electronics, you need one regenerator per wavelength, per fiber section, but an optical amplifier lets you send multiple wavelengths through a single amplifier."

The result, McDermott says, is not only lower cost, but lower risk of failure due to less equipment in the plant. "The fewer number of devices in the network, the more reliability is enhanced," he notes.

Ciena's Bilter anticipates that more survivability will be built into WDM systems moving into the future, including switching and restoration capabilities now handled by Sonet. "Today's network survivability is handled by Sonet, but I think tomorrow's network survivability will be handled by the WDM layer," Bilter says.

Not all bits are equal

Driving these advances toward more ubiquitous reliability is the effect that data traffic has had on the public network. As more and more people send and receive data over the network, it becomes harder to keep up, says George Foley, broadband networking director at Lucent. "Voice networks require fixed bandwidth," Foley says. "Data relies on a more statistical basis, as opposed to a pure dedicated bandwidth basis. It varies, and requires a certain amount of flexibility."

Data also requires a more robust network than voice. While a voice call can recover fairly quickly from a facility failure—losing one or two packets typically means only a audible 'click' or 'pop' over the line—losing a few data packets could be a major problem.

Asynchronous transfer mode (ATM) over Sonet is being put forward as the best way to cater to the statistical nature of data traffic without giving up the reliability of Sonet transport. ATM in itself tends to be less inherently reliable than Sonet. While ATM has the capability to do automatic rerouting, it takes longer than Sonet—as long as minutes in complex networks, compared to 50 milliseconds delivered by Sonet, says Robert Pullen, vice president of engineering and marketing at Tellabs (Lisle, Ill.). In fact, Pullen says, he has seen the re-routing process place such a strain on ATM switch processors that they re-set, causing the switch to fail.

"If someone digs up a fiber or there's a line or connector problem, so the path suddenly isn't there, and the mesh net of ATM switches starts to reroute cells, that takes a lot of horsepower," Pullen says. "The processors aren't designed to do that, so that's more than likely to result in an ATM switch failure somewhere in the network."

On the other hand, statistical multiplexing enables ATM to offer Quality of Service (QoS) guarantees and provides a more efficient use of bandwidth than time division multiplexing (TDM). In addition, ATM has self-checking error codes that allow the destination to verify that the information received is the information sent.

ATM riding over Sonet is the best way to maximize reliability and efficiency in handling data traffic, particularly given ATM's high-speed switching capabilities, says Rob Mapes, product manager for the Matrix broadband access platform at Reltec (Irving, Texas). "ATM lets you carry tremendous amounts of data at high speeds over a single pipe," Mapes says. "The bottom line is that there is so much speed condensed into a single pipe, when the network goes down it affects many, many customers because the capacity is so great. That's why you need a reliable underlying architecture like Sonet."

Deepak Chopra and the public network

Industry experts agree that, regardless of how reliable a network's technology is, certain golden rules apply when it comes to how reliable the network is overall.

Rule No. 1 is that people make mistakes. "If you're sending people into the network to make changes, they tend to break things just as much as they improve them," says Brian McFadden, assistant vice president of high capacity systems for Nortel (Brampton, Ontario). "Less people means better reliability results. It's no accident that the Bell operating companies report their highest levels of reliability occur during times when there's no one in the building."

If carriers do not centralize their operations, administration and maintenance, they run the risk of troubleshooting their network on a one-by-one basis, which can make any problems even worse.

"Some network problems manifest themselves in multiple different places in the network," McFadden says. "If you're dealing with each problem individually, chances are you're not going to recognize that it's a network-wide problem. It's taking a holistic approach to the network—looking at it as a whole, instead of just putting more pills in it."

Golden Rule No. 2 is that new technology doesn't help the network, and can even hurt it, if the network's operational systems aren't brought up to speed. "There is a risk of new technology having a negative impact on reliability," says Tellabs' Pullen. "Everything from the management systems to the operational support systems may not be mature enough yet, and a result there could be service interruptions. For example, things like difficulties in provisioning could result in outages or failed circuits. The operational procedures need to be at the same level as the new technology, otherwise it could adversely affect the status of the network."

Tied into the first two is the third and final golden rule, which is that like a stew, the more different ingredients that are tossed into the network pot, the more carefully it needs to be watched as a whole.

"If a service provider is throwing in all sorts of network equipment, such as ATM or WDM or anything else, it has to be overly cautious on how it will impact the overall network reliability," says Jim Sauer, manager of the broadband transport group at Fujitsu (Richardson, Texas).

The solution to that, Sauer says, is just plain-old common sense. "It's easy to decrease the reliability of the network," Sauer says. "Just don't take advantage of redundancy, exploit capacity without considering how it affects the network and compromise quality by cutting cost. It's much harder to engineer the network for a consistent level of reliability." ■

"It's no accident that the Bell operating companies report their highest levels of reliability occur during times when there's no one in the building"

—Brian McFadden, Nortel

SPECIAL ASSIGNMENT

THE IMPACT OF CHANGING TECHNOLOGIES

Removing The Cable Staple

Tree-and-branch architectures are making way for full-service networks.

By Charles Mason

Senior editor of *America's Network*

A reliable, robust network is considered the backbone of modern telecommunications services. Such networks being built today can make service providers powerhouses in the delivery of broadband as well as plain old telephone service (POTS).

As a result of developing markets and the advent of competition, the cable TV (CATV) industry has been moving (slowly) toward making its architecture more suitable for robust, two-way communications. Yesterday's cable staple—the traditional tree-and-branch design—is giving way to architectures and networks that can pass muster as full-service, reliable networks.

Much has been made about the CATV industry's bad customer service rating and poorly maintained outside plant. These issues, coupled with sharply rising rates for service, led to industry re-regulation in the early 1990s. However, with CATV's newly won freedom under the Telecommunications Act of 1996, quality issues are starting to become yesterday's news, as the industry moves to upgrade its image and improve its networks.

Entertainment—the CATV industry's *raison d`etre*—is not a lifeline service. But with CATV companies once again focusing on how to become one-stop providers of broadband and narrowband services, it's time to change philosophies.

"The cable plant was definitely not originally designed for top-notch reliability that a lifeline service requires," acknowledges Wayne Partington, group manager of product marketing and customer management at the Broadband Media Group of Tellabs Operations Inc. (Bolingbrook, Ill.). Technology developments are allowing operators to install fiber deep into their systems and use far fewer amplifiers, which not only reduces costs but also improves reliability, he notes.

Moreover, vendors that serve the CATV sector it have tightened up their specifications and are moving toward a greater degree of filtering, eliminating a bane of CATV networks—signal leakage and interference. Partington and other industry insiders maintain that today's hybrid/fiber coax (HFC) networks are almost at parity with their traditionally reliable, wireline counterparts. "There has been pressure on vendors to start building products that are customized to the special rigors and environment that CATV plants are subject to," Partington says.

The future of cable plant that can deliver lifeline services at competitive rates rests on HFC's inherent cost-effectiveness and reliability. James A. Chiddix, senior vice president of engineering and technology at Time Warner Cable Inc. (Stamford, Conn.), says that broadband optical fiber technology "is the key enabling technology behind the architectural changes which are now underway in the CATV industry.

"Broadband fiber makes possible the construction of highly cost-effective HFC networks with the capability of carrying a huge amount of information modulated in various ways onto a variety of carriers for transport to home or business, and the corresponding transport of information in the opposite direction back from the user premises through the same coaxial cable and through the same or a parallel optical fiber to the originating point of the network," Chiddix says. "It takes advantage of fiber's very low transmission losses to allow the reconfiguration of the architecture of a broadband coaxial network."

The concept of using broadband fiber links within a CATV system architecture is said to have originated with Chiddix and Dave Pangrac, engineers at what is now Time Warner Cable (formerly American Television & Communications Corp.; ATC). Both had experience with FM fiber and digital fiber applications, and were struck with the possibility of modulating a laser with the full CATV spectrum so that it might be converted simply at a remote point to allow for coaxial delivery—analogous to the use of microwave, with its block conversion of multiple carriers down from the microwave spectrum to the CATV spectrum.

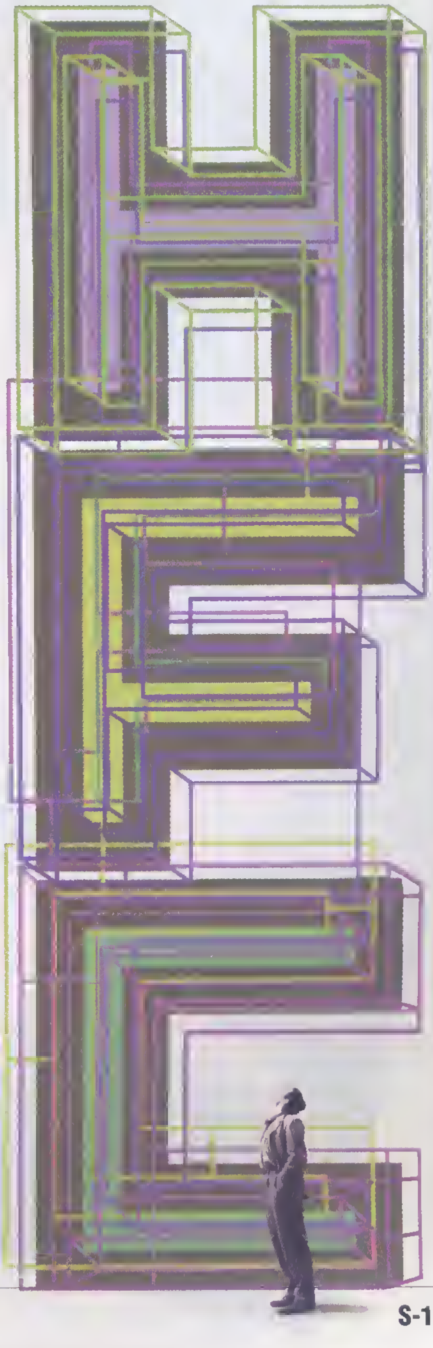
In late 1987 Chiddix, Pangrac and an associate demonstrated a working 40-channel, CATV link transporting signals through 8 km. of singlemode optical fiber to a National Cable Television Association (NCTA) engineering committee. The demonstration involved a NEC distributed feedback laser (DFL). Members of the NCTA committee were interested, and discussions between ATC and several manufacturers followed. The goal was to optimize NEC's laser technology to support this application. Chiddix and Pangrac wrote a paper for presentation at the NCTA convention in 1988.

In September 1988, ATC engineers installed an AT&T broadband fiber link in an Orlando, Fla., CATV system to back up a 12 GHz AM microwave feed that often faded during heavy rains. The link worked so well that it immediately became the primary feed, with the microwave relegated to a seldom-used backup.

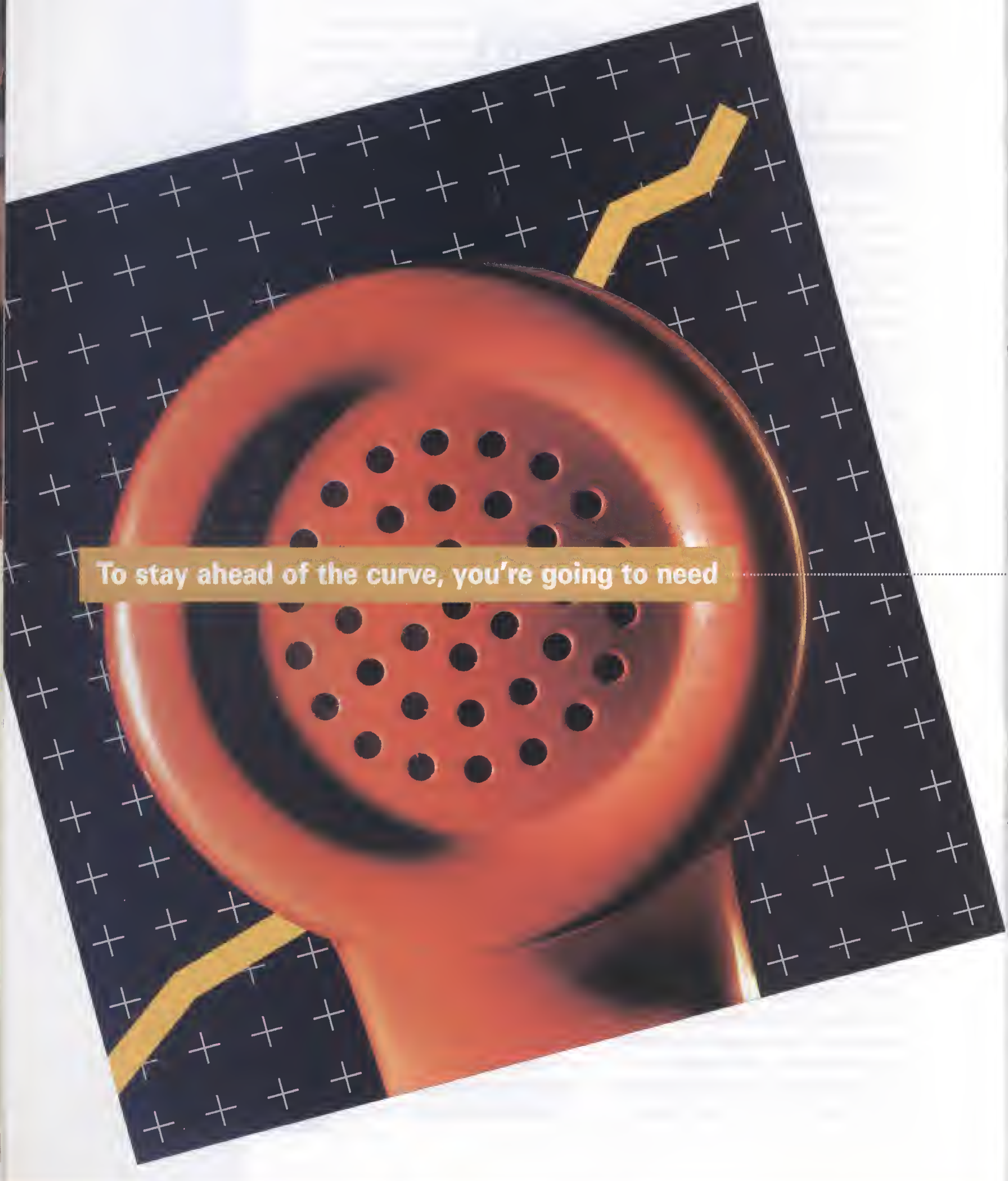
At that point, AT&T began to market a product line using this technology. At the same time, Ortel Corp. developed a distributed feedback laser with such sufficiently good specifications that General Instrument Corp. began marketing a line of broadband fiber products using Ortel lasers. Scientific-Atlanta Corp. and other manufacturers soon followed, using DFLs from a variety of Japanese manufacturers.

Chiddix said at the time that adoption of fiber optic trunking, which fed relatively small areas of the existing coaxial network, had a more profound implication: HFC networks enjoyed significantly increased, usable bandwidth compared to traditional cable architecture, and had a separate fiber trunking path into each relatively small area or neighborhood. This implied that switching technology could be adopted, which would make

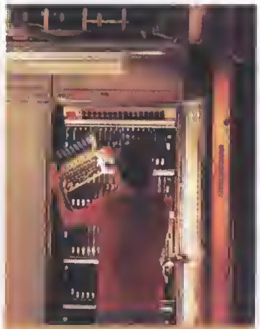
continued on page S-16



SIEMENS

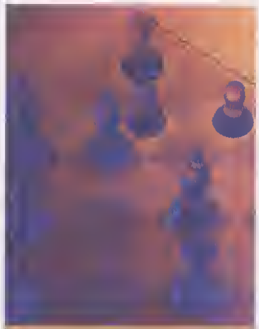

To stay ahead of the curve, you're going to need

1-800-814-1680
www.stn.siemens.com



this

and this



and this.

To stay ahead of the curve in today's competitive telecommunications marketplace, you need the right plan, the right technologies, and the right level of support. In short, you need Siemens. As an industry leader providing full service telecom solutions, we offer the applications and expertise that can differentiate your services...from consolidated billing to automated provisioning to integrated voice and data...and beyond. **We're Siemens. We can do that.**

Siemens Telecom Networks. What can we do for you?

use of the increased capacity and the multiplication of that capacity by the number of fiber trunks to provide switched services to individual customers, according to Chiddix.

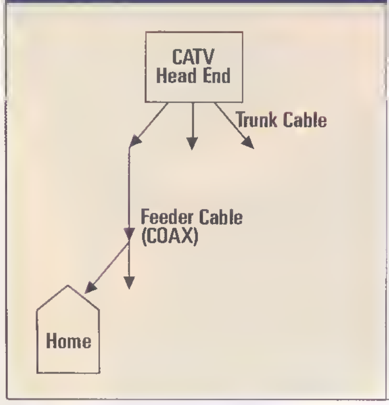
The first step took place in Time Warner's New York operation in the borough of Queens, where the coaxial cable plant serving several thousand customers was upgraded using fiber trunks, each serving a neighborhood with a coaxial radius of about 1 km. to deliver 1 GHz of bandwidth carrying 150 analog television channels. The company pushed coaxial amplifier and set-top converter technologies to accommodate the increased bandwidth.

Time Warner took the next step when it developed its fully switched digital system for 4,000 customers in Orlando. While that system proved costly to deploy and operate, company executives and others within the industry note that the basic underpinnings are sound.

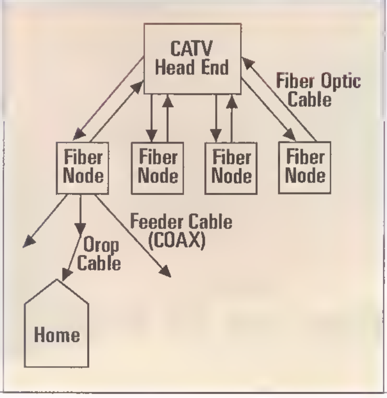
It is fiber's low-loss characteristic that provides its primary contribution to broadband signal distribution architecture, Chiddix notes. Coaxial cable has plenty of bandwidth and is highly cost-effective, but has relatively high signal-transmission-loss characteristics.

Michael Adams, senior project engineer of advanced engineering at Time Warner Cable, says the network will evolve from a pure digital broadcast system into an interactive system and, ultimately, into a video-on-demand-capable system. Time Warner is pushing ahead with its Pegasus network architecture, designed to integrate broadcast and interactive services into a single network architecture. Pegasus is a genuine communications network, allowing new services to be added as they become available. Standard protocols—Internet protocol (IP) routing and asynchronous transport mode (ATM) switching—are used to build an open network at lower cost than existing proprietary approaches. MPEG-2 transport supports integrated digital broadcast and interactive services, and ATM is used to switch interactive multimedia only where justified.

Traditional CATV System Architecture



HFC System Architecture

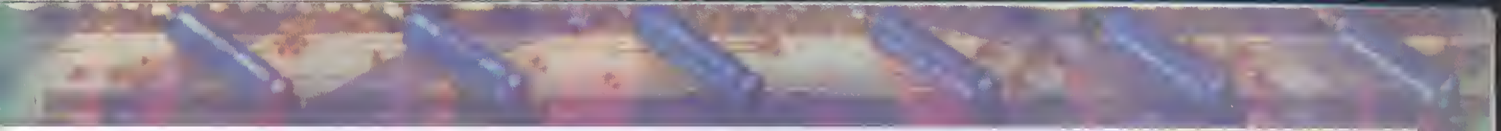


Cox pursues telecom strategy

Arguably, no other CATV company is deploying advanced services faster than Cox Communications Inc. (Atlanta). Cox's residential telephone service was launched Sept. 10, 1997, in Orange County, Calif., and Dec. 1, 1997, in Omaha, Neb. The Orange County system initially served an area with 1,500 homes and is now available to 19,200 homes. Of those, Cox has marketed the service to 16,900 homes—about 5% of total homes to which the service is available and 6% of marketed homes. Significantly, in the first area where Cox Digital Telephone was introduced—i.e., where the company has marketed the service the longest—the penetration is 17%.

Chuck McElroy says the market is ready. "Our initial results here in Orange County indicate that customers see Cox Digital Telephone as a better choice for local and long distance services," says Cox's vice president of residential broadband services. McElroy says his company is offering to provide second lines at a significant savings—reportedly 50% less than Pacific Bell's price in Orange County.

Cox has received regulatory approval to deliver phone service in nine markets nationwide, and has installed telephone switching equipment in seven of those



markets. The service is expected to be launched in San Diego, Hartford, Conn., and Phoenix in 1998.

The company also is moving ahead with its digital TV strategy. Lynne Elander, Cox's director of product development, describes Cox Digital TV as a "defensive and offensive" strategy to help Cox maintain growth in its core video business and to appeal to customers "with a huge appetite for more viewing choices." She noted that, compared to direct broadcast satellite (DBS) providers, Cox Digital TV delivers comparable digital quality, greater reliability and as many (or more) channels.

Cox is also delivering voice and data services to commercial customers through its Fibernet subsidiary, a competitive access business. Cox Fibernet reportedly serves more than 420 commercial buildings with nearly 3,000 route miles of fiber optic network in four cities; the business unit is constructing operations in six other markets. The company also recently launched Cox@Work, which offers high-speed Internet access and work-at-home solutions for businesses.

HFC's role

According to Cox executives, the lynchpin of their strategies is based on HFC. Meeting and beating the competition for new and existing services is going to require the industry to provide the kind of reliability and flexibility found in the ring-in-ring architecture, according to McElroy. (Using a real-world example, a cut on a fiber cable coming out of the head end with 144 active fibers took nearly one day to repair, averaging about 10 minutes to prepare and make the splice for each fiber.)

McElroy says that a new standard for reliability is critical to provide future applications that impact consumers' health, safety and livelihoods. Examples include POTS with E-911 capability; work-at-home data transfer and home banking services; and home security monitoring. The highest level of reliability is difficult—if not impossible—to provide using home-run fibers or star topologies, mostly because of accidents such as fiber damage due to backhoe cuts, torn down utility poles or even house fires.

Cox executives note that, according to the Federal Communications Commission's Network Reliability Council, the industry average for repair of a fiber cut is 4.7 hours. That, they say, will not be acceptable for these future applications, particularly when applied to Bellcore standards for telephone service, which establishes the average customer outage time at less than 53 minutes per year (99.99% availability).

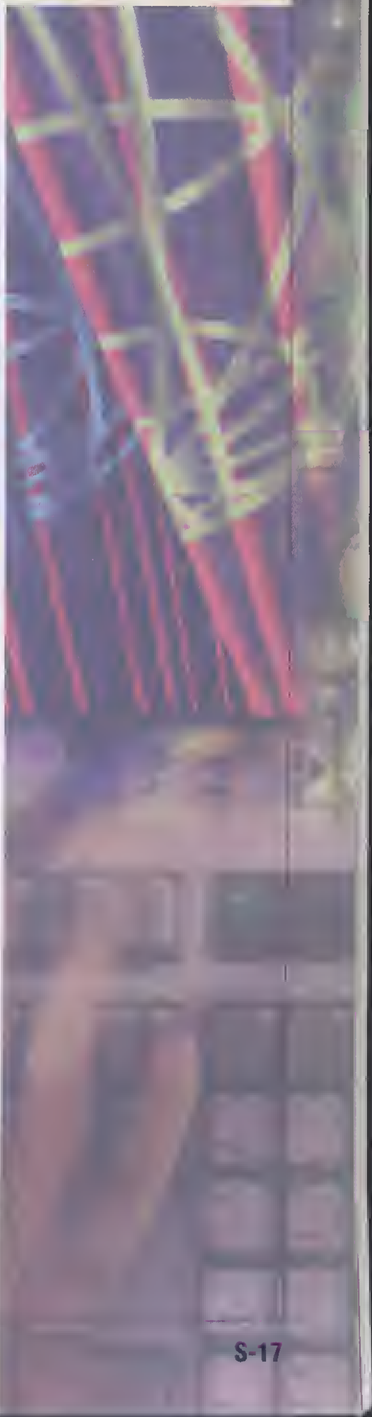
The ring-in-ring architecture provides nearly 100% reliability because two diverse paths are provided. In the event of a fiber cut, service is maintained via the second diverse path. Through the unique combination of a dedicated and a loop-through design, the ring-in-ring architecture provides greater flexibility than today's star-bus architecture, Cox says.

The proof

Tim Wilk, director of strategic planning at Scientific-Atlanta Inc., says deployment of HFC networks has significantly increased network reliability and service bandwidth and, in turn, has opened the door for increased applications of work-at-home data networks, wideband Internet access, telephony and new transactional-based video services.

A critical performance measure of these new HFC networks is availability, Wilk says. A downtime of 53 minutes per year (or a network availability of 99.99%) has been the targeted standard for narrowband telephony networks. Unfortunately, published reports on HFC network availability have been developed using an inadequate source of data, comprised from a mixture of trunk and feeder statistics, theoretical failure rates, and vendor records of warranty returns, he contends.

> **"Meeting and beating the competition for new and existing services is going to require the industry to provide the kind of reliability and flexibility found in the ring-in-ring architecture."**
>
> —Chuck McElroy,
> Cox Communications



"By simply adhering to a smaller-homes-passed guideline, a significant improvement is achieved in the measured reliability through the reduction of series elements."

—Tim Wilk, Scientific-Atlanta

During 1995, Scientific-Atlanta worked with a number of CATV operators to collect and analyze data on their HFC architectures. The report reviewed the results of the reliability study to understand the elements of HFC reliability, and to identify and prioritize potential improvement areas in terms of downtime reduction and associated costs.

The manufacturer enlisted the assistance of several large CATV operators to test the issue of HFC reliability. The study included diverse geographic regions, and sampled test sites passed a total of 374,525 homes, and included more than 3,000 miles of coax and over 600 miles of fiber plant.

Results of the field study reveal that not only are established HFC networks performing better than expected, but current design implementations should enable new HFC architectures to achieve the network availability target of 99.99% for telephony services, Wilk says.

The selection criteria for the HFC study sites was based on a number of factors:

- Each system had undergone a rebuild or upgrade within the last three years and used a current CATV hybrid fiber coax architecture;
- The systems had active reverse plant in operation;
- Emphasis had been placed on repair and maintenance programs, including extended hourly scheduling of repair crews and 24-hour availability; and
- Each system operator had maintained detailed records for all network failures and outage durations, and was willing to share the data.

The systems' key differences provided a foundation for comparison and sensitivity analysis. Node sizes varied widely, ranging from as low as 500 to nearly 2,000 homes passed. The systems each chose a different HFC implementation path, ranging from total reuse of existing coax to a complete rebuild with new coax. One CATV operator had begun a program to reduce power-related failures.

Although the measured availability of these sites do not achieve the target 99.99%, this does not imply that the sites cannot achieve this objective, Wilk maintains. Operators are downsizing their nodal architectures toward a 500 homes-passed objective.

By maintaining component failure and other field data, variations were introduced to the reference model to analyze the impact of specific architecture modifications and redundancy options. These variations include:

- Reduced node size;
- Standby powering;
- New coax vs. upgraded coax;
- A redundant fiber system; and
- Drop improvements.

Most of these variations are being incorporated in current HFC design practices. As a result, new HFC systems using these changes are probably realizing the corresponding improvements.

By simply adhering to a smaller-homes-passed guideline, a significant improvement is achieved in the measured reliability through the reduction of series elements, Wilk adds.

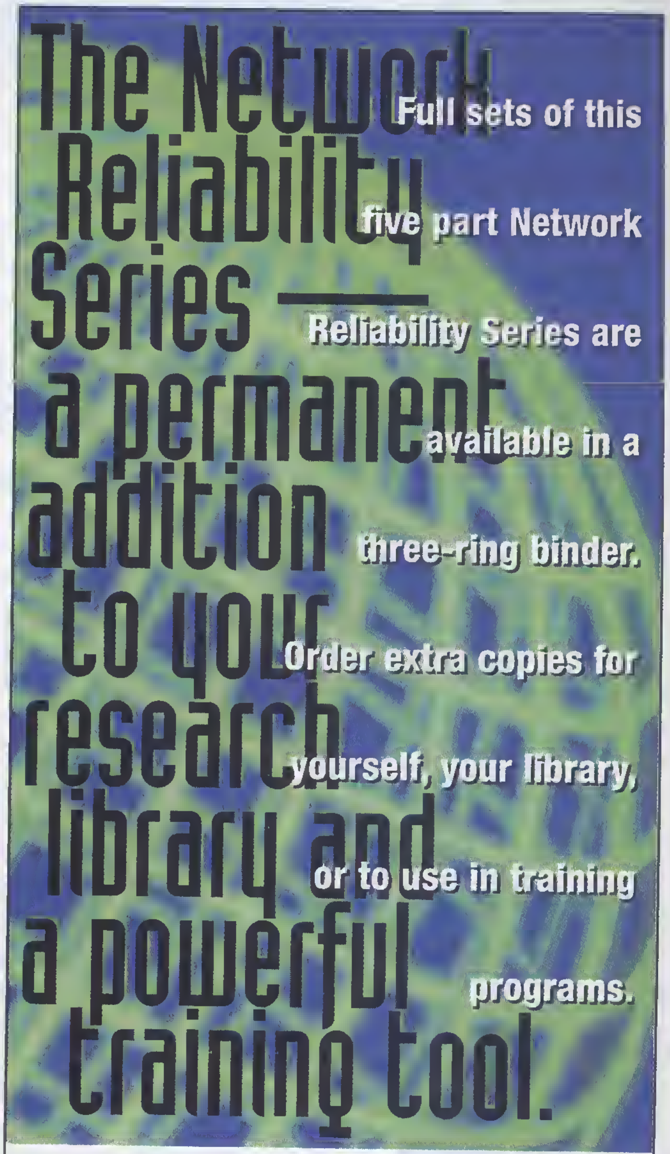
In a separate report based on this study, Wilk says that powering upgrades offer the fastest and most economically efficient means of improving network reliability for an existing HFC system designed around a larger node size (1,000-2,000). For the three sample sites in the company's study, an upgrade to 100% standby power and heavy-duty power inserters reduced power-related outage time by an average of 82% (23 minutes). Wilk says that, in his company's sample, most of the systems had standby power provisioned at the node; thus much of the potential improvement was captured as part of the node size reduction. Assurance of 100% standby coupled with rigorous grounding and surge protection practices further reduced downtime by 4.2 minutes in the smaller 500-home node.

In several HFC architectures optimized for 100% telephony, a centralized power node has replaced individual power supplies. These nodes supply power for the HFC components as well as telephony electronics. Power nodes are fully redundant and typically have a minimum eight-hour standby battery supply or local generator backup. The modeled improvements associated with centralized power nodes further reduce outage times by nearly five minutes.

A potential weakness in an HFC network is coax. Wilk claims that coaxial-related failures of the test sites were surprisingly high, contributing 28 outage minutes annually, or 23% of the total downtime. Coaxial failures included cable cuts, breaks, cracks, water damage, and splice and connector problems. Expressed as "failures per coax mile," a wide variance was again noted between the three sites: over 24% of the Northeast cable miles incurred a failure, compared to 9.3% and 1.6% in the Northwest and Southeast sites, respectively.

Coaxial failure variations are explained by the philosophy each operator had maintained during plant upgrades, he says. One site completely rebuilt the plant, replacing 100% of the old coaxial cable. Another site overlashed new coax in about a third of plant miles. Stress induced to the old coax during the upgrade process induced numerous cracks and water damage over time. As a result, the operator was forced to schedule planned outages (and additional downtime) to replace damaged coax as part of the maintenance program.

Operators planning new build or complete rebuilds will not be faced with this magnitude of coaxial failures, Wilk notes. Considering ongoing maintenance and customer interruptions, Wilk says that operators may wish to reassess the long-term implication of salvaging older cable during plant upgrades. ■



The Network Reliability Series — a permanent addition to your research library and a powerful training tool.

Full sets of this five part Network Reliability Series are available in a three-ring binder. Order extra copies for yourself, your library, or to use in training programs.

☐ **Yes, send me the complete Network Reliability Series in a 3-ring binder.**

Name____________________

Title____________________

Company____________________

Address____________________

____

Phone __________ Fax __________

Quantity _____ full sets at $10.00/ea.

Total amount enclosed $ __________.

Simply fill out the form above, enclose a check for the total amount due, payable to *America's Network*, and mail to: *America's Network*, 312 W. Randolph St., Suite 600, Chicago, IL 60606-8926, Attn: Network Reliability Series. **For more information, call 312-553-8900.**

The Reliability Of Wireless Networks

How much safety can you afford?

By Curt Harler

A telecommunications writer based in Strongville, Ohio.

Like a mountaineer perched on a ridge line, wireless providers walk a razor's edge between two kinds of disaster. On the one side is the typical scare: equipment failure and service outage. On the other side is the specter of financial failure should too much revenue be invested in network infrastructure at the expense of marketing.

Catastrophe looms on both sides. Given competitive market conditions, wireless service providers do not have the option of returning to camp and waiting for better weather.

For service providers in the grips of a life-and-death struggle to produce revenues, the idea of spending a pile of money on disaster recovery or Quality of Service (QoS) features is unthinkable. On the other hand, in a game played for keeps, it's tough to win without the proper equipment and the ability to guarantee service to customers.

The way for network providers to keep from falling (or jumping) off the cliff is to have them implement short-term measures that will guarantee survival until the storm subsides and they're able to roll out more elegant solutions.

Meet the mountain

Difficulties on the backhaul is the No. 1 reliability problem faced by wireless carriers, according to Jim Barrett, R&D applications development manager for the Spokane (Wash.) division of Hewlett-Packard Co. (HP; Palo Alto, Calif.). Although this may seem counter-intuitive, Barrett maintains that 30% to 70% of the problems on individual networks are related to difficulties in the backhaul. Most would think that the interconnections between wireless and wireline networks would be easier to maintain than the radio frequency (RF) portion, but HP's experience says otherwise. It's one of those things often taken for granted—like a huge expedition to Everest failing because someone forgot to bring warm socks.

Second on the list of problems is the interconnection within the cell site. While this is more an installation than a maintenance concern, it's responsible for a surprising number of wireless network failures. Next come the difficulties with the transmit power segment—the area outward from the power amplifiers in the cell site. Problems with antennas and feed lines are another typical cause for outages. Fifth on the list is received interference, which can be caused by a company's own antennas being too close to one another on a tower, or by jamming signals from

Top five reliability problems with wireless networks

- **Difficulties in the backhaul network**
- **Interconnection within the cell site**
- **Transmit power segment problems**
- **Antenna and feed line problems**
- **Received interference**

Design/Photoillustrations: Frans Evenhuis/Weidenhoefer Design Studio

other transmitters. All of these issues affect survivability and quality of transmission.

The battle for service quality and reliability will be fought on the network side, according to Bob Egan, research director for The Gartner Group (Stamford, Conn.). Egan argues that the attention given the battle of the standards—Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and Global System for Mobilization (GSM)—misses the point. Rather than looking at IS-95 (CDMA) or IS-136 (TDMA), he predicts that IS-41c will make or break all service providers. IS-41c provides the hooks, transport and header spaces that allow a carrier's switch to trigger on certain events.

Personal communications services (PCS) providers are lagging on the analog side of the market. There is no doubt that this is due to financial priorities—generating cash to meet payroll is more important at this stage of the industry than reaching for 99.999% network availability.

Egan predicts that providing various QoS levels for users will be a key sales point, allowing wireless carriers to avoid falling into the chasm of lost market share. The emerging availability of digital systems will allow network providers to establish priority classes. Egan envisions a Bronze level of service to everyday users; a Silver level, addressing system availability and dropped calls to attract business customers; and a Gold level, which would be sold to utilities, public safety groups and others whose ability to communicate is literally a life-or-death situation. Gold service would include guarantees of fully provisioned handsets, ready to go, in time of disaster. However, Egan notes, most wireless operators still are in the early stages of rolling out any kind of service at all, and are not looking at quality issues.

"As an industry, we are on top of things in GSM and TDMA," Barrett says. "CDMA is still in its infancy." He qualifies this comment by stating that the CDMA networks installed have not been running long enough for operators or testers to get a feel for the technology's reliability and robustness.

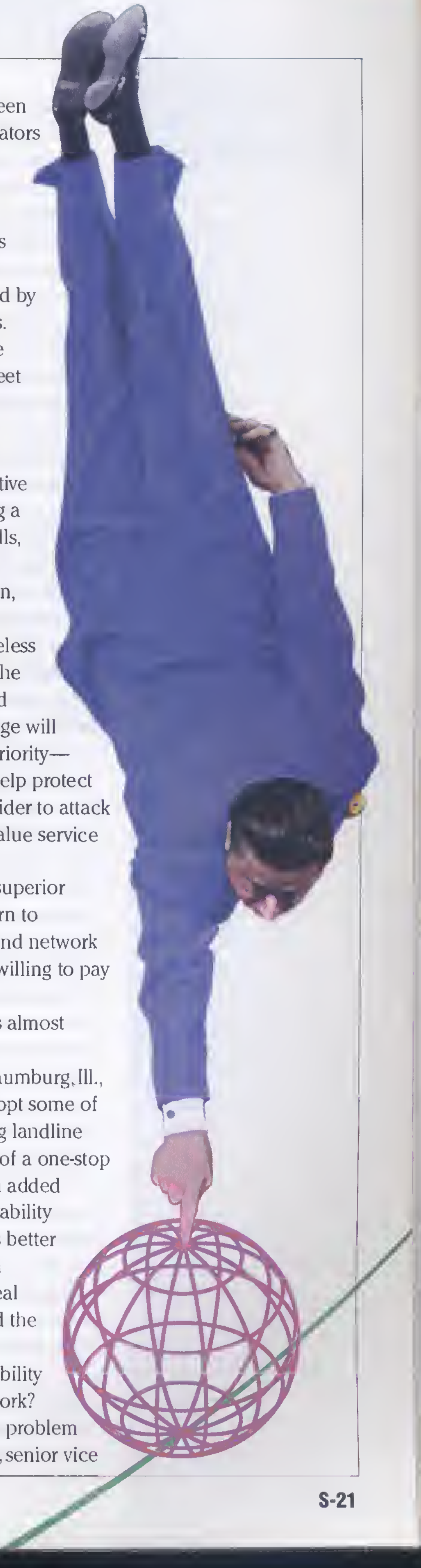
Test equipment companies have the test suits and test equipment capabilities needed by wireless providers, Barrett says. Although wireless is still in the foothills of the scramble to meet QoS issues, "market forces will change to service quality and reliability issues," he notes.

Carriers can gain competitive advantage simply by providing a service with fewer blocked calls, fewer dropped calls and less crosstalk, says Carl Robert Aron, national director of EDS Management Consulting's wireless practice. Aron maintains that the primary drivers of product and service as a source of advantage will be quality and technical superiority—two factors, he says, that will help protect price or allow a superior provider to attack the competition with added-value service at the same price.

"Delivering demonstrably superior service on attributes of concern to customers, such as coverage and network quality, will attract customers willing to pay a premium," Aron says.

The name "Cellular One" is almost synonymous with wireless communications. But the Schaumburg, Ill., provider has attempted to co-opt some of the wireline market by offering landline long-distance services as part of a one-stop shopping package. While each added service provides further survivability challenges, offering customers better service packages will ensure a company will be around to deal with emerging technology and the challenges it poses.

The most common survivability problem for any wireless network? Adverse radio conditions. "The problem is ubiquitous," says Gary Lomp, senior vice



What carriers can do today

- **Train technicians on wireless network architectures**
- **Perform periodic panametric tests on radio portion of the network**
- **Perform return-loss sweeps on the antenna, cable and feed lines**
- **Test the T1 or ATM backhaul network to ensure correct operation**

president and chief technical officer at InterDigital Corp. (King of Prussia, Pa.). Multipath propagation conditions and signal fade long have been recognized as pitfalls on the climb to wireless quality. Long claims InterDigital's Broadband-CDMA (B-CDMA) product will survive such problems far more readily than any other system out today.

While it has no intrinsic benefits against CDMA or GSM in the event of a power failure (or "Act of God"), B-CDMA can operate as a standalone on an individual cell basis. Damage to one cell will not affect another cell adversely, Lomp claims. In addition, the system's architecture has no single point of failure, because no critical path is involved.

While there is plenty of competition among wireless systems, they all go up against the "real Everest"—the installed wireline base. For wireless to compete with wireline, reliability figures will have to exceed the 99.9% level, Egan says. Current industry statistics range from 95% to 99.7%—but nothing in that range is acceptable long-term. In fact, this is uncharted territory for wireless providers. What carriers really need, Egan argues, is a true measure of availability that takes into account the critical 4C's: coverage, capacity, capability and cost.

Anything that interferes with reception—because of factors intrinsic to the network or due to external forces—hurts wireless carriers. Clear, static-free reception is paramount. According to a December 1997 study by InfoCom for the Personal Communications Industry Association (PCIA), 96% of respondents cited reception as being important, second only to those requiring wireless access in an emergency. With customers placing demand pressures like that on service providers, it's obvious that consistency and QoS are going to be make-or-break factors.

Tools for the climb

Wireless carriers today cannot afford to ensure system survivability, it's argued. That is, the dollar cost of building redundant or high-quality systems is too great when the conventional systems in place are not yet paying for themselves. The main issue companies will face in the future is cost vs. functionality.

One survivability area which could be improved today and at little cost is the location of cell sites. It only requires a measure of planning before network deployment, according to Matthias Glanz, manager of product planning for the Wireless Business Unit of Siemens Telecom Networks (Boca Raton, Fla.). Although Siemens is a strong supporter of GSM, Glanz's ideas would work at any installation. He recommends network engineers identify key areas that require the highest service levels and the greatest amount of redundancy. Then, rather than scattering microcells to provide additional capacity, plan a second base station to cover the area, he says.

While acknowledging that the solution costs somewhat more than microcells, it has the added benefit of giving complete redundancy in a key service area. Although the solution only makes sense in situations with critical coverage needs, it's a straightforward way to provide the infrastructure needed to meet QoS demands.

InterDigital's Lomp would agree that engineering elegant solutions now is the most effective way to ensure survival in the competitive storms to come. The reason many operators are slow to upgrade hardware, he says, is that they have not yet gotten the required return on investment (ROI) on their installed base.

"Either they made a bad choice originally, or they have not repaid their initial investment," Lomp says. He encourages operators to consider upgrading the quality and reliability of their networks as they expand, moving to more advanced technology, step-by-step. Existing technology can be retired by attrition.

Lomp says he'd like to see his B-CDMA installed side-by-side with IS-95 equipment

(as it's backward compatible with IS-95 gear). He feels the broadband wireless technology is the answer to the "network breathing" challenge which often results in poor or dropped service at the network's edge. Especially under high load with many users at the boundary, IS-95 is prone to system crashes, Lomp maintains. Although he concedes that such conditions are atypical, he adds that survivable networks cannot be designed to deal with optimal conditions, but most function well in the face of the most demanding storm of users.

Part of the problem with CDMA in general is a lack of trained technicians, Barrett says. The nature of the CDMA network gives rise to many more choices; it's possible to make tradeoffs with call capacity, quality and cost, he notes. The broad lack of experience in this area means the industry still does not have its arms around the factors involved with these decisions. "We need to learn about it and get good at it," he says.

Until the industry develops a cadre of experienced technicians to troubleshoot and optimize CDMA networks, Barrett recommends carriers consider automated test packages. These software-based units remove the burden from the technician, allowing the box to do the test and pinpoint the source of difficulty.

Many other forthcoming, attractive hardware solutions will help network operators ensure survivability. Base stations with full N+1 redundancy should be available in the next two years, Glanz says. A three-sector base station may be able to handle 20 calls per sector. Added hardware will allow the base station to take advantage of algorithms that will reconfigure the base station should one module fail. Those reconfiguration algorithms will depend on traffic patterns. Early versions will require intervention by a remote operator. Future systems will be reconfigured dynamically without human intervention, dropping response times from minutes to seconds.

Using asynchronous transfer mode (ATM) in the backhaul gives service providers more flexibility in network topology, Glanz adds. A redundant pulse-code modulation (PCM) link can serve as a lukewarm standby to connect cell sites or base stations on different routes, he says.

Higher up the mountain

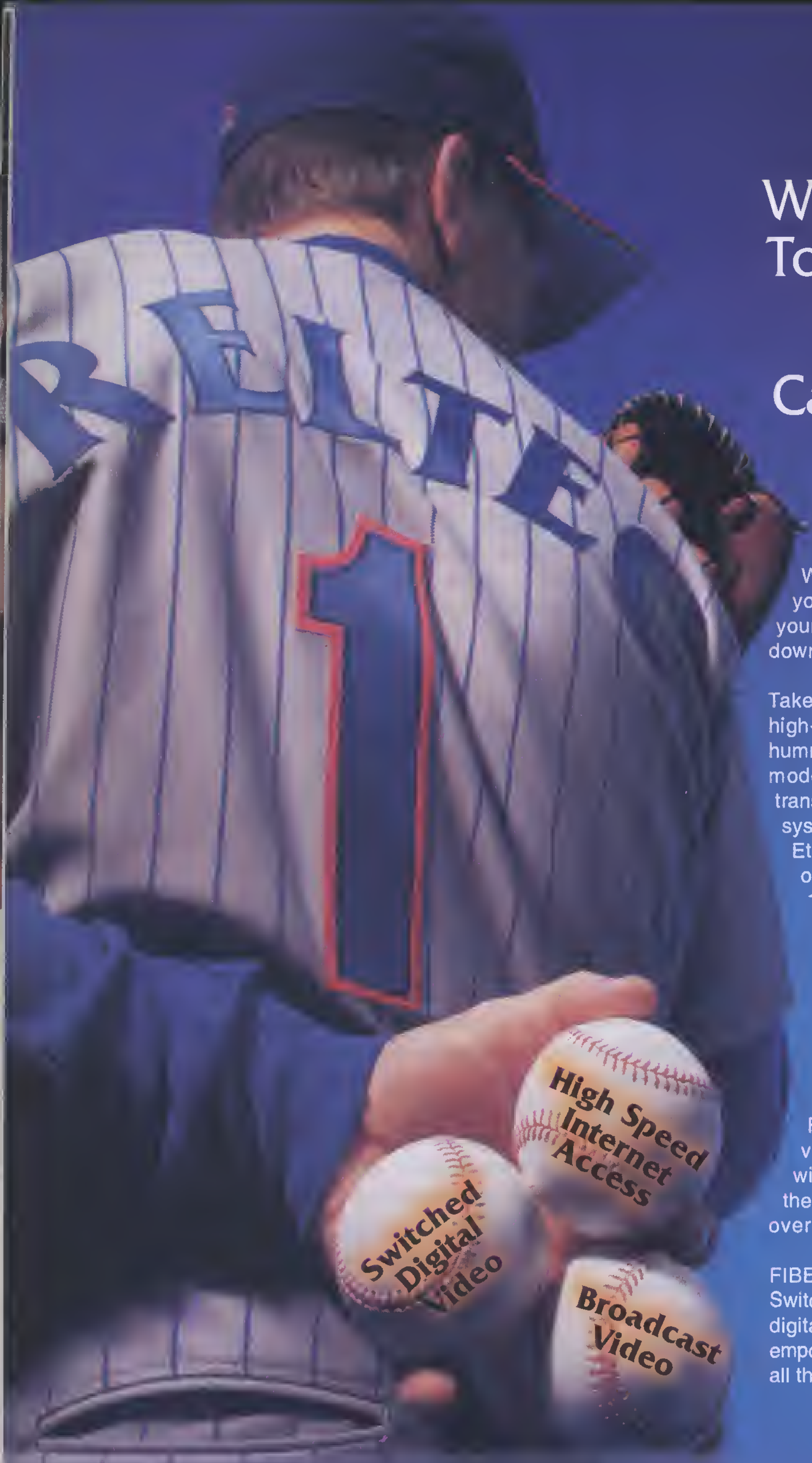
There will be good PCS and digital cellular networks in the core metropolitan areas in the United States within the next 18 months, Egan predicts. In 24 months, that level of service will expand into perimeter metro regions, including the corridors between work and home.

Barrett recommends carriers do all they can to train technicians on wireless systems and perform periodic tests on the radio portions of any wireless network. Other key suggestions are to perform return-loss sweeps on the antenna, the cables and the feed lines going to the antennas. Keeping in mind the universality of problems on the backhaul segment, Barrett also recommends spending a fair amount of time testing the T1 or ATM network, and ensuring its correct operation. He predicts that in three years, many of these tests will be straightforward. More subtle questions on network optimization and cost minimization will become crucial.

In three years, the intelligent wireless network will be up and running. This network will be able to handle data, location positioning and a host of other applications. In each case, Egan maintains, IS-41 will become more important as service levels are added to the system.

On the technology side, Glanz agrees that hardware to allow improved redundancy and reliability will be available in the next couple of years. "The next major step in the newest generation of technology will be coming to market by 2000 or 2001," he says.

Today, the peak of performance perfection is still far off. It is, however, a worthy goal for each service provider, unless it wants to find itself frozen out of business.■



Want To Add Zip To Your Network Deliveries?

Catch This Pitch.

With RELTEC's innovative access solutions, you'll be delivering just the right pitches to your customers—lightning fast and straight down the broadband pipe.

Take our Ethernet-based FIBERST★R™ high-speed Internet access solution. It's a hummer—nearly 400 times faster than 28.8Kb/s modems, and 70 times faster than ISDN! By transporting TCP/IP packets over fiber-based systems, FIBERST★R effectively extends an Ethernet LAN into each subscriber's home over a symmetrical, full-duplex, 10Mb/s, 10BaseT connection. You deliver high speed and high reliability at low cost—and users don't consume precious CO switch fabric.

Our repertoire also features Switched Digital Video—seamless, integrated ATM-based interactive service delivery to subscribers over a Fiber-to-the-Curb (FTTC) distribution architecture. Our FiberCast™ analog and digital broadcast video can be merged with narrowband, wideband and broadband ATM traffic at the HDT and transported to the ONU—over the same fiber link.

FIBERST★R high-speed Internet access. Switched Digital Video. FiberCast analog and digital broadcast video. A potent line-up that empowers your network and positions you to cover all the bases in meeting your customer needs.

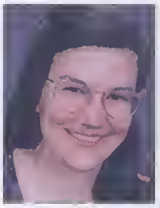
To learn more about RELTEC's advanced network solutions, FAX your name, company, interest area and telephone number to us at **1-800-800-1280** today.

RELTEC™

SPECIAL ASSIGNMENT

THE IMPACT OF CHANGING TECHNOLOGIES

Worth the Risks



By Annie Lindstrom

Senior editor of *America's Network*

The introduction of advanced intelligent network (AIN) technology has simplified, energized and facilitated the deployment of many new and reliable services in today's public switched telephone network (PSTN). That's because AIN liberated service providers from the ties that previously bound them to their central office (CO) switch vendors when introducing services.

No longer do service providers have to install the software that supports a particular service onto each and every switch in their networks to offer a service ubiquitously. AIN also often spares them the burden of ensuring that different switch vendors' software interoperates and supports similar service features.

Deployment of integrated services digital network (ISDN) was delayed for many years until major switch vendors' agreed to support the National ISDN standard. However, there are times when interoperability is an issue.

"Even though AIN is a well-defined standard, there are still cases where there are nuances that vary by switch," says Rob Ziemba Jr., director of market management for intelligent network solutions at Bellcore (Morristown, N.J.). "However, with AIN, you can solve switch incompatibility problems, rather than rely on the vendors."

Despite the advantages, moving intelligence out of the switch and onto service control point (SCP) databases shifts a network's points of vulnerability. That's because SCPs support many more customers than an individual switch, so if something goes wrong, many more people are affected. However, AIN-based solutions are developed with this fact in mind.

The SCP itself and the path that connects the CO switches to it are additional points of vulnerability. Messages are sent between the CO switches, also known as service switching points (SSPs) in the AIN world, and SCPs via Signaling System 7 (SS7) links. Signal transfer points (STPs) direct the messages to the appropriate switch and SCP (Figure 1).

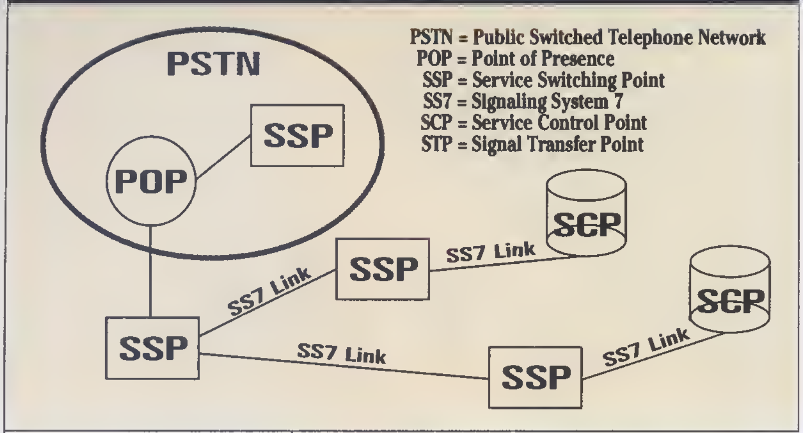
"The reliability theorem says that the fewer piece parts you have, the greater reliability you have. So as opposed to having a couple of thousand individual switches, each being vulnerable for failure, you end up with fewer platforms," says John Young, vice president of AIN development and support for Bell Atlantic (New York). "From a theoretical perspective, AIN should make the networks more reliable. But conversely, someone might say that, because you have to go outside the CO and travel over the SS7 network, you could be vulnerable to cable cuts and other things."

continued on page S-26

"From a theoretical perspective, AIN should make the networks more reliable. But conversely, someone might say that, because you have to go outside the CO and travel over the SS7 network, you could be vulnerable to cable cuts and other things."

John Young, Bell Atlantic

Figure 1: AIN ARCHITECTURE


PSTN = Public Switched Telephone Network
POP = Point of Presence
SSP = Service Switching Point
SS7 = Signaling System 7
SCP = Service Control Point
STP = Signal Transfer Point
PSTN
SSP
POP
SCP
SSP
SS7 Link
SS7 Link
SCP
SSP
SS7 Link
SS7 Link
SSP

The Achilles' heel

An AIN architecture is only as strong as its weakest link. However, going beyond the call of duty by exceeding recommended diversity and capacity standards on SS7 links is not always enough to keep a network out of danger. Just ask Illuminet (Olympia, Wash.). Last fall, Illuminet, a nationwide provider of SS7 and AIN services, suffered a network outage that lasted for more than 10 hours. A hardware failure in a multiplexer at one of Illuminet's supplier's facilities in Mattoon, Ill., took down several T1 (1.544 Mbps) lines carrying SS7 traffic. That traffic was rerouted (as planned) to an STP located in Rock Hill, S.C.

Even though the network performed properly, a combination of unusually heavy traffic and a flood of network management messages incited by the failure choked the alternate route. The flood of information caused the backup STP to misinterpret the network management messages, and it began shutting down perfectly healthy SS7 links, according to Roger Moore, CEO and president of Illuminet. The company worked with its supplier to get the situation under control as quickly as possible.

The fiber facilities, which failed late on a Sunday night, were restored to service at 9:40 a.m. on Monday morning. The network was stabilized and cleared of resulting congestion by 1 p.m.

After the outage, Illuminet examined its network and discussed the incident with the STP vendor, which Moore declines to name. As a result of its assessment of the outage, Illuminet:

- Installed additional SS7 facilities, which had been on order before the outage occurred;
- Installed a new release of software, which did not become available until after the outage, that contains an option which allows service providers to reduce the number of network management messages a network sends out during an outage; and
- Purchased a Hewlett Packard acceSS7 network-wide SS7 surveillance system, which improves the visibility of congestion in the network. Illuminet will complete installation by April.

Illuminet is not the first carrier to be affected by an outage of this type, nor is it likely to be the last, says Tony Mitchell, senior associate for Booz Allen & Hamilton Inc. (McClean, Va.) "What is comes down to is, are all the intelligent network architectures sound in how they are being implemented? Most people would say 'yes,' " he says. "But you cannot engineer for every contingency."

Service providers can engineer redundancy into their networks at the physical, logical and functional levels, but technical, regulatory and business pressures are causing a real need for coordination. It's conceivable that one network could be used to deliver AIN services to three different service providers. A service provider or subscriber that does not check to ensure that it has true diversity may not have it at all, Mitchell notes.

"Sometimes a carrier will use another carrier, who may be using another carrier, to provide your links," Moore says. "You may find that you might still have diverse links, but they are coming through a common area, where if you have a failure like a fiber cut, you still get impacted." This was not a problem in the

> "Sometimes a carrier will use another carrier, who may be using another carrier, to provide your links. You may find that you might still have diverse links, but they are coming through a common area, where if you have a failure like a fiber cut, you still get impacted."
>
> —Roger Moore, Illuminet

Your Internet Revenues Today.
Your Internet Revenues with FIBERST★R™.

Want to see your internet access revenues explode? Just make it easier, cheaper and faster for customers to connect and browse. That's the idea behind FIBERST★R, the world's most cost-effective Ethernet-based access solution.

FIBERST★R provides high-speed (over 300 times faster than 28.8kb/s modems) connectivity to your subscribers using cost-effective Fiber-in-the Loop technology. That's right. Without resorting to ISDN, cable modems or ADSL schemes, FIBERST★R delivers feature-rich, high-speed data in full duplex symmetrical transport.

FIBERST★R transports Ethernet TCP/IP packets over fiber based systems, effectively extending an Ethernet LAN into each subscriber's home or office. The subscriber's investment for faster connects, high-speed access and real-time audio and video capabilities? A single LAN card they probably already have. FIBERST★R's Ethernet-based architecture also conserves expensive switch fabric by routing "time-hungry" Internet service off the telephony network.

Low cost deployment for you. Less expensive and easier to use service for your customer. There simply is no better Internet access system than FIBERST★R.

Start getting a bigger bang for your Internet buck. Call us at **1-800-233-2334** for more information on FIBERST★R.

RELTEC™

FIBERST★R is a trademark of RELTEC Corporation.

How long did it take your subscribers to download a couple of those Martian rock pictures?

(Of course, they probably used the time productively. Like, maybe, perusing a couple of your competitors' brochures.)

Ironic, isn't it? We can drive a little car around on a planet 34 million miles away. But your customers have to "watch paint dry" just to see the pictures. Of course it's not your fault. It's the limitations of the net, itself. That's why Nortel is helping companies like yours build The New Internet.™ We're launching a whole range of new products and services, like 1-Meg Modems that make 56K look downright sluggish. And our proven Internet

©1997 Northern Telecom. Nortel and the Nortel Globemark are trademarks of Northern Telecom. Sojourner,™ Mars Rover™ and Spacecraft design and Images are ©1996-97, California Institute of Technology. All rights reserved.

THRUWAY™ THAT CAN SAVE ISPS UP TO 30% ON ACCESS CHARGES. WHAT'S BETTER THAN LOYAL CUSTOMERS? ECSTATIC ONES. TO LEARN MORE ABOUT HOW NORTEL CAN HELP YOU OFFER SUBSCRIBERS AN INTERNET THAT'S FASTER, MORE RELIABLE AND (FOR YOU) MORE PROFITABLE, CALL 1-800-4NORTEL, DEPARTMENT 88, OR VISIT WWW.NORTEL.COM.

NORTEL
NORTHERN TELECOM

Figure 2: Difference in cost between a point solution and AIN solution

Calls per day	Cost (point) per call	Cost (network) per call
28,000	$0.18	$0.22
112,000	$0.10	$0.08
448,000	$0.08	$0.03

Reasons:

- **Economies of scale of equipment**
- **All calls routed to point of equipment**
- **No calls routed to network-grade application (call control and tracking performed via SS7)**

Source: AG Communications

> "Reliability concerns have made testing and developing new services extremely expensive. Developing new services is a trial-and-error process, and developers can spend a lot of money to develop something that ultimately doesn't work in the marketplace."
>
> –Rob Smith
> GTE Intelligent Network Services

Mattoon outage, he adds.

Illuminet, which leases the majority of its facilities from AT&T (Basking Ridge, N.J.) has seen such things occur in the past and, as a result, regularly asks its carriers to report back on how the facilities Illuminet leases are engineered, just to ensure their diversity, Moore notes. "Over time, you can lose visibility to whether or not the facility is still designed the way it was originally, and possibly suffer a loss of diversity."

Human touch

Carriers also must ensure that features of one AIN service are compatible with features of another. Just as modern pharmacies make sure their customers are not taking multiple drugs that will interact detrimentally, the network engineer must see to it that users of multiple AIN-based services do not suffer from negative interactions of disparate services.

"It's usually not the basic architecture that messes up the network. It's the software as it relates to a single customer, not the entire population," Young says. "In the past, it has been fairly easy to make sure that the service logic works. The difficulty has been will the service logic work in this particular example, in this particular situation for this particular customer."

The same type of coordination will be required as intelligent customer premises equipment (CPE) is more commonly used, Young adds. "A handshake and precedent will have to be set for actions taken in both the AIN and CPE domains so that they can coexist with one another," he says.

With regard for interconnection between networks, AIN databases are (for the most part) islands within each company's network; however, there will be a need to interconnect them over the next three to five years, Young adds.

The Intelligent Network Forum (INF) plans to release a framework document that defines issues for interconnecting intelligent networks and SS7 networks this quarter, according to Mona Johnson, INF chair and president of Technical Marketing Services (St. Petersburg, Fla.). The group is also working on a testing requirements document, she adds.

Point, counterpoint

Services such as prepaid calling can be deployed on an AIN platform or as a point solution, which is basically a piece of equipment that supports one application, rather than several, as an AIN database does. Wireless providers in particular, who are racing to acquire customers as they build their networks, have turned to point solutions rather than AIN-based solutions to save time and money. However, they may face reliability and manageability difficulties down the road, says Carl Glaeser, vice president of INgage Solutions for AG Communication Systems (Phoenix, Ariz.). True savings are usually reaped only in early stages of deployment (Figure 2).

"Those little point solution boxes aren't made to withstand power failures and they don't have sturdy disc drives, so if that box fails, your prepaid calls don't get connected," adds Hilo Oltman, director of marketing for INgage. "Our prepaid call solution uses a fault-tolerant SCP that won't break. If you route calls to intelligent network equipment that has been engineered for a higher standard of performance, you don't risk having the network brought down."

Nevertheless, the emphasis on reliability adds time and expense to the development of AIN-based services.

"Reliability concerns have made testing and developing new services extremely expensive," says Rob Smith, product manager for GTE Intelligent Network Services (Irving, Texas). "Developing new services is a trial-and-error process, and developers can spend a lot of money to develop something that ultimately doesn't work in the marketplace."

The fact that AIN services have to be reliable under high-traffic circumstances limits service providers' ability to test as many services as they want, as it's an expensive proposition, Smith adds.

Major AIN successes such as 800 number portability, enhanced 800 services, credit card validation, calling name identification and the soon-to-be-deployed local number portability have made AIN a more accepted technology over the last few years.

"800 service is a good example that says that reliability does not necessarily have to suffer when calls travel through an IN architecture," says David Barclay, manager of product marketing of advanced network services for Lucent Technologies Inc. (Murray Hill, N.J.).

"Our ISCP has been in live service since 1992 and we have not had one service-affecting outage as a result of an ISCP failing," Bellcore's Ziemba says. "And we've seen query volumes double on a yearly basis. There is a lot of activity going into SCPs, STPs and the SS7 network, and they are all holding up well."

Fault tolerant vs. fault resilient

The underlying architecture of AIN is changing, as the power of general computing processors has increased enough to use them (rather than telecom-specific processors) to support the hardware on which AIN software resides, Barclay says. Lucent and other vendors see fault-resilient, rather than fault-tolerant, systems as the future. Lucent's fault-resilient SCP Star Server product line is highly reliable, yet much less expensive, Barclay explains.

"The difference between fault-resilient and fault-tolerant is that fault-tolerant systems tend to run in lock-step with one another with active and standby processors that tend to be more expensive," he says (Figure 3). "Fault-resilient systems use a more distributed processing approach in which both processors run at the same time. One processor takes over the entire operation if the other fails. When things are not so tightly coupled, you have a better chance of not duplicating the same condition on the alternate processor."

These days, hardware is less and less responsible for outages. Software and human errors are usually to blame, Barclay adds.

Over the next several years, the focus of activity in the PSTN will be opening up the network, Ziemba says. Keeping the network reliable as more and more players get involved is the biggest reliability challenge going forward. ■

Figure 3: Reliability Characteristics

Characteristic	Fault tolerant	Fault resilient
Failure detection	x	x
Failure recovery	x	x
No single point of failure	x	x
Mirrored disks	x	x
Immediate disk failover	x	x
Duplicated power supply	x	x
Immediate CPU failover	x	
CPU failover via re-initialization		x
Recovery from system hang		x

Fault-tolerant and fault-resilient approaches are both robust.
Fault-resilient configuration recovers from system hangs, a major cause of downtime.

Source: Lucent Technologies

The Network Reliability Series is sponsored by

FUJITSU

Lucent Technologies
Bell Labs Innovations

SIEMENS

RELTEC™

NORTEL
NORTHERN TELECOM

Instant INSIGHT

ROBERT ROSENBERG

Profiling the killer app

America's most wanted? Service portability.

Profiling the killer app is easy: it's cheap, simple to administer and highly portable. But with a profile that fits the new product rap sheet being touted by every marketing department in the industry, who do we finger?

Insight's "most wanted" is the application that drives true service portability, because service portability is the key to unlocking the billions of dollars in the wholesale-to-retail distribution chain. If we find platforms that enable any mid-sized business to buy bandwidth at wholesale rates, brand it and retail a service to a consumer using home-grown marketing skills, we found the motive, the means and the real killer app.

We've got two suspects that fit the service portability profile: the intelligent network (IN) and the network computer (NC). The former fits a traditional telephone company model of service deployment, while the latter subverts it and could become the weapon that gives any mid-sized business the ability to brand voice and data services.

Delivering service portability means continuing to invest in evolving the IN. Today, many of the features that could be associated with a customer's profile are switch-based, including custom local area signaling services (CLASS) features such as three-way calling, call forwarding, call transfer and caller ID. Making a service profile available to visited networks would require home location registers (HLRs)—the databases that contain each subscriber's profile—to be moved off switches and onto IN platforms along with concomitant upgrades to the signaling networks to accommodate the added traffic.

Large regional or nationwide carriers are moving HLR information off the switch to support new services and their specialized platforms, but the process won't be completed even by 2000. Insight's research on IN suggests handsome paybacks for carriers willing to continue making the investments. On IN's wireless side, service revenue will grow at a compounded rate just over 50%, from about $2 billion in 1997 to more than $20 billion by 2002 (see table). Traditional carriers are going to continue making IN investments even as they wonder whether the NC is a means to service portability and thus fits the profile of the killer app.

Robert Rosenberg is president of the Insight Research Corp., a Parsippany, N.J.-based consultancy providing comparative market research and competitive analysis. Insight's recent work includes studies in the areas of OSS, wireless IN and resale.

It previously seemed that the underlying network infrastructure was going to remain voice-oriented and narrowband, and services would be constrained by the limitations of the circuit-switched delivery model. The Internet has changed the rules. Broadband networking is fact, and intelligence that existed only in multimillion-dollar service control points is moving toward the network's periphery.

Wireless IN service provider revenue (1997–2002)

1997	$2.8 billion
1998	$5.8 billion
1999	$11.6 billion
2000	$17.4 billion
2001	$21.5 billion
2002	$22.4 billion

Source: Insight Research

If intelligence migrates to the edge, and the price of bandwidth continues to fall under competitive pressures, backbone service becomes a commodity. Provisioning services may depend on nothing more than distributing highly customizable applications that run on generic computing platforms—not specialized switching or transmission platforms.

Many suppliers are working on software that would enable a bank, grocery store or retail outlet to provide services comparable to what a phone company provides today. The Internet has proven that it's possible to route among millions of end points without a telco switch setting up the call. The Telecom Act, which requires phone line access to every residence to be resold by the local telco, gives retailers the opportunity to establish their own networks and more closely tie the customer to their brands. Inexpensive computing platforms are the basic tools needed to act like a phone company.

What's missing (and where the development dollars are going) is the bundled software needed to set up basic voice and data applications, as well as the administration and billing software. Distribution of software to create and maintain end user service profiles across the backbone network will not be an issue for long, and the NC architecture championed by Sun and Oracle are likely to overcome these issues.

The killer application is service portability. The real mystery is whether computing or telecom vendors will be holding the smoking gun. ■

SHIRA LEVINE

Killer Apps:

Billing with an attitude

Billing systems metamorphose into comprehensive customer management programs.

THERE WAS A TIME WHEN A BILLING SYSTEM DID JUST WHAT ITS NAME IMPLIES—IT GENERATED BILLS, ONE PER SERVICE. CUSTOMERS RECEIVED THEM, PAID THEM, END OF STORY.

BUT THAT WAS IN THE DARK AGES, BACK WHEN CARRIERS WERE MONOPOLISTS, BASIC DIALTONE WAS THE NORM AND DINOSAURS RULED THE EARTH.

"In the old paradigm, the bill is a monologue," says Paul O'Brien, vice president of the communications industry business unit at NCR (Dayton, Ohio). "The carrier sends it to you, you read it and pay it, and that's that. There's no interactive relationship there.' "

Service providers historically have not seen the need for a more in-depth relationship. If a carrier is the only game in town (as is still the case in many local phone markets) there's not much of a business incentive to get cozy with the customers. Flexible billing? Enhanced services? Customer care? Humbug.

As the long distance industry has found out over the last few years, however, customers are quick to jump ship, once they're given a choice. Even with the limited amount of competition in the local phone market, 6% of customers have changed their local service provider within the last 12 months, according to a recent survey conducted by Price Waterhouse (New York) and Kenan Systems (Cambridge, Mass.). The most common reason, after a change of address, is a better base price for service, followed by a special promotional price, lack of response to the customer's inquiries by the service provider and the ability to obtain desired features with the new service provider.

CHURN CONTROL

The Telecommunications Act of 1996 ensures that more churning is inevitable. As barriers to entry in the local market come down, incumbent local exchange carriers (ILECs) will begin entering new markets themselves, creating even more competition in the long distance, video services and high-speed data markets.

As telecom markets have been deregulated and competition has heated up, ILECs have been forced to re-evaluate their strengths and weaknesses, says Frank Perras, senior manager with Andersen Consulting (Philadelphia). "We've been doing work with some of the largest phone companies worldwide as deregulation has occurred," Perras says. "As barriers of entry are lowered and increasing amounts of competition are coming into the marketplace, carriers are asking, 'What do I have in terms of strengths, and what do my customers want?'

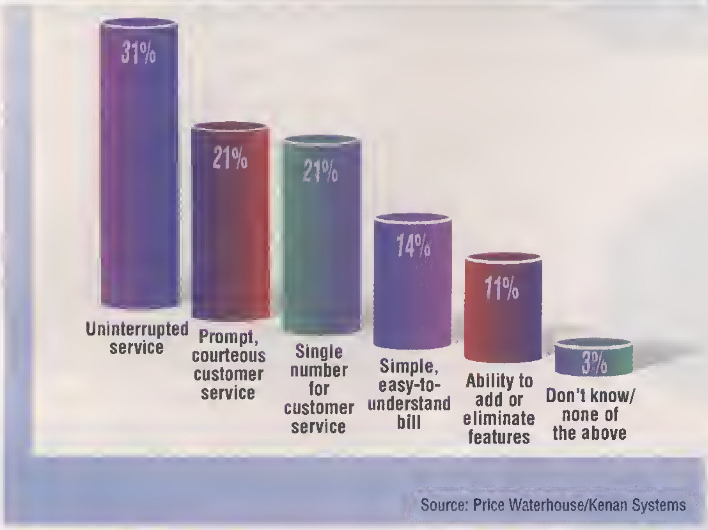
> **Customers who skip among carriers trolling for the lowest price aren't likely to be worth keeping, anyway.**

Lower prices, for one, but surveys have shown that, in the long run, consumers prefer a good service offering and solid customer service over low prices, particularly in the business market. Service quality tends to degrade during a price war, as carriers cut corners to lower their operating costs, and customers who skip among carriers trolling for the lowest price aren't likely to be worth keeping, anyway. With that in mind, most carriers are focusing on improving the value of the service.

With the bill as the historical point of contact between carrier and customer, service providers are viewing their billing systems as the first step toward a better relationship with the no-longer-captive consumer.

"Many companies are starting to believe that the source of keeping customers loyal should be at the level of the bill," O'Brien says. "If the bill is easy to understand, readable, offers different options, it can be a tool to keep the customer from switching carriers."

Figure 1: What customers rate as their highest priority in good customer service



Source: Price Waterhouse/Kenan Systems

Survey says . . . keep it simple

Customers opt for single carrier, single bill

Consumers want to purchase their communications services from a single company and receive a single bill, according to a survey conducted last year by Kenan Systems Corp. and Price Waterhouse Entertainment, Media and Communications Group (New York).

Of the 1,005 consumers polled for the survey, 55% said they would prefer to buy multiple services—local, long distance and wireless telephone service, CATV and satellite television and Internet service—from a single company, as opposed to 33% who would prefer to deal with separate companies for each service.

Local telcos are leading the race to be consumers' company of choice, with 40% of interviewees responding that they would want their local service provider to handle all of their home communications needs. Long distance carriers took second place with 21%, while wireless, cable, satellite and Internet service providers (ISPs) all fell in the single-digits.

In fact, wireless carriers, video-based companies and ISPs all received low scores in the customer service arena. When asked to evaluate the level of customer service they have received, 36% of respondents rated their local telco and 40% rated their long distance carrier as "excellent." In contrast, 16% gave their CATV or satellite TV provider the highest rating, while only 11% rated their cellular phone carrier's customer service as "excellent" and a scant 4% characterized their ISP as "excellent."

As service providers face those bleak figures, Price Waterhouse expects customer management to gain new significance in 1998. Its "EMC Technology Forecast: 1998" predicts that carriers will increasingly use advanced customer management tools such as call centers, data warehousing and flexible billing systems to help acquire, track and retain customers. —*S.L.*

For one thing, a clear, reader-friendly bill can show the consumer what services he has, what he's paying for them and where he's saving money. "People want to be able to trust their carrier, which means they need to understand their service and see where they're getting value," says Harry Merkin, marketing manager at Kenan Systems. "When they trust the carrier, they'll even pay more if they know they're getting good service."

BENEFITS OF BUNDLING

Another key differentiator in a competitive market is expected to be the capability to bundle services as carriers move into new markets—a local exchange carrier offering cable TV (CATV) or Internet services, for example. A customer who buys more than one service from a single carrier is 50% less likely to churn, Merkin says. Despite widespread and dire warnings about sticker shock, the Price Waterhouse/Kenan survey found that the majority of consumers would prefer a single bill for all services.

At the very least, customers should be able to choose whether they receive one consolidated bill for multiple services, separate bills, or separate statements on a single bill (called electronic stapling), says Robert McKenzie, vice president of marketing at CableData Inc. (Rancho Cordova, Calif.).

"The idea is providing customers with more options in communications with their carrier." The result is what McKenzie calls a customer management system, a combination billing/customer care system that integrates billing information with demographic and other marketing information gleaned about the customer to create a "strategic weapon" for the service provider. "It's a way to hold onto a customer for as long as possible," McKenzie says. "It lets you collect information to create a profile of the customer, so you know what kind of packages and services to offer, what that customer wants, so you can provide the maximum value."

A customer who buys more than one service from a single carrier is 50% less likely to churn.

HOOKING IT ALL TOGETHER

But little of that is possible with the antiquated billing systems that most of the regional Bell operating companies (RBOCs) and other ILECs have in place. The old mainframe-based, legacy systems are written in Common Business Oriented Language (COBOL), a programming language not conducive to flexibility, Merkin says.

Thus, many carriers are building interfaces onto their legacy systems that enable them to hook their existing billing systems into integrated customer management platforms. The next crucial step is to tie the billing system into the carrier's other network operations support systems (OSSs), including provisioning and service management, says Ed Fullman, senior vice president of the communications practice at Claremont Technology Group (Basking Ridge, N.J.).

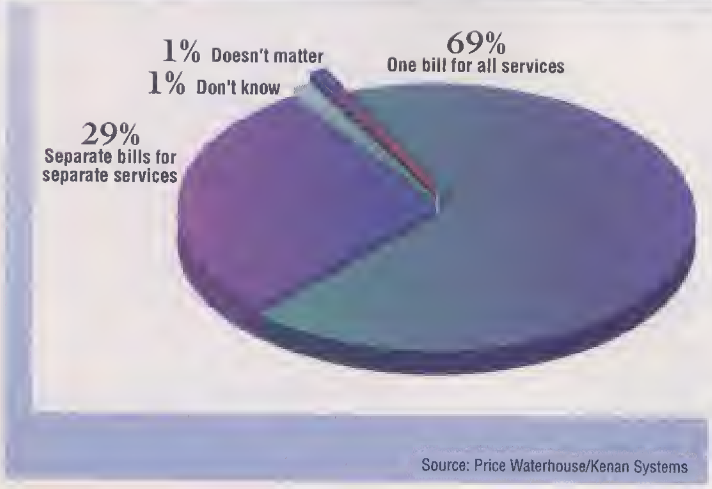
"If all that isn't really integrated, you can have a billing system that can do everything including slice bread and tie your shoes in the morning, but it's essentially handicapped," Fullman says. "In the end, it doesn't change anything if you put in a new billing engine, but the new features can't be accessed because the legacy environment can't do it."

Another necessity is integrating the billing system with a data warehouse, says Andersen Consulting's Perras. Information captured by the customer management system can be used in two ways—on a customer-by-customer basis for individual sales and marketing efforts, and in a global data warehouse on a more segment-wide basis, he says. For example, a carrier might want access to a large business customer's usage and billing history when it comes time to renew the service contract—information that would be stored in the customer management system's database. At the same time, that information would be fed into a data warehouse for long-term analysis.

However, Fullman warns against combining the two. "I think a lot of data warehousing that's going on now is a stopgap measure, because carriers can't get their billing and customer care environment truly integrated," he says. "The data warehouse should be used for strategic, not tactical analysis."

Ultimately, it's a slow, but worthwhile process, says NCR's O'Brien. "It's a journey," he says. "The applications are available, but they're not quite robust enough. And all the service providers are looking at taking action in this space. A lot of them are even in the early stages of implementation. But it's a whole new mindset for them." ■

Figure 2: How consumers prefer to receive their bill from a service provider for multiple services



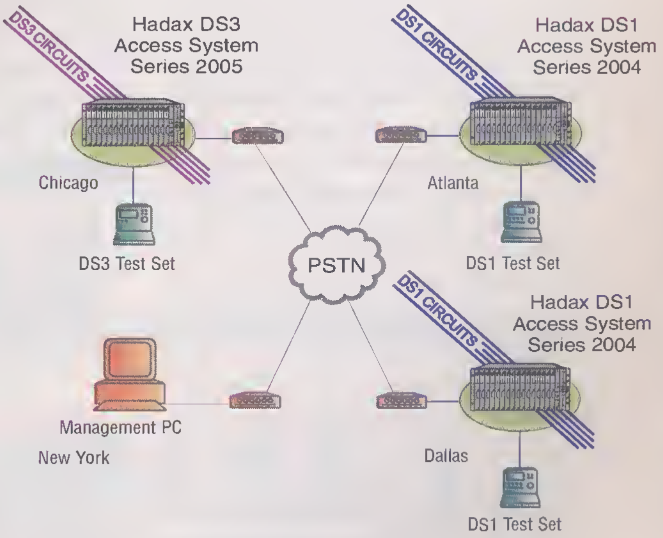
Source: Price Waterhouse/Kenan Systems

Still Sending A Technician Every Time There's A DS1/DS3 Line Problem? Get Up To Speed!

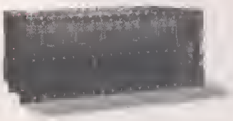
Hadax Access Systems for remote testing and monitoring: Your quick, inexpensive and convenient alternative.

Imagine how much time and money you'd save if you didn't have to send technicians to monitor or test lines in remote locations. With the HADAX 2004/2005 Access Systems, network operators can connect test devices to DS1 or DS3 lines from a central location. Best of all, you can perform access and testing functions similar to a DCS for as little as 10% of the cost.

Don't let travel time limit your network availability. Gain instant "remote control" over your DS1/DS3 lines today.



For more information, call toll-free 888-60-HADAX.



HADAX is an ISO 9001 registered company for your assurance of quality.

Circle 110

HADAX

www.hadax.com

310 Phillips Ave. South Hackensack, NJ 07606 (888) 60-HADAX Fax: (201) 807-1782

ANNIE LINDSTROM

Killer Apps:

Earning and learning

Telecommuting and distance learning aren't just show demos anymore.

ADULTS are bringing home the bacon without ever leaving home. Kids in grades K–12 can go to college without leaving their classroom seats. Telecommuting and distance learning have grown out of the show floor demo phase to become part of the normal routines of young and old. In turn, these applications have changed the shape of the PSTN.

Carriers have deployed thousands of integrated services digital network (ISDN) basic rate interface (BRI) and primary rate interface (PRI) lines to provide teleworkers and distance learners with the bandwidth for voice, video and data. Bell Atlantic (New York) has experienced a 45% to 50% growth rate in ISDN BRI lines since 1994, about half of which can be attributed to telecommuting, according to Chris Pizzirani, the regional Bell operating company's (RBOC's) ISDN BRI product manager. Bell Atlantic has more than 330,000 BRI connections region-wide.

For SBC Communications Inc. (San Antonio), telecommuters account for 51% of the 140,000 BRI lines installed in the RBOC's seven-state territory, says Fernando Hernandez, senior director of business access services for SBC. "ISDN has really taken off in the last 30 to 36 months," Hernandez says. Cheaper and faster hardware, packaged solutions, and easier ordering and installation processes and procedures have combined with applications such as telecommuting to boost ISDN's acceptance. SBC expects to add 50,000 lines to its network in 1998, he says.

In Texas and California, ISDN is available to 99% of subscribers, Hernandez says. A mandate passed three years ago by the Texas legislature (H.B. 2120) requires SBC to make ISDN available throughout its franchise area to "anyone who wants it," he notes. Outside of regulatory requirements, SBC offers telecommuters two turnkey packaged ISDN solutions—TurboAccess, available in the former Southwestern Bell territory, and Office Pack in Pacific Bell territory. Both services will be available in both operating territories this year, Hernandez says.

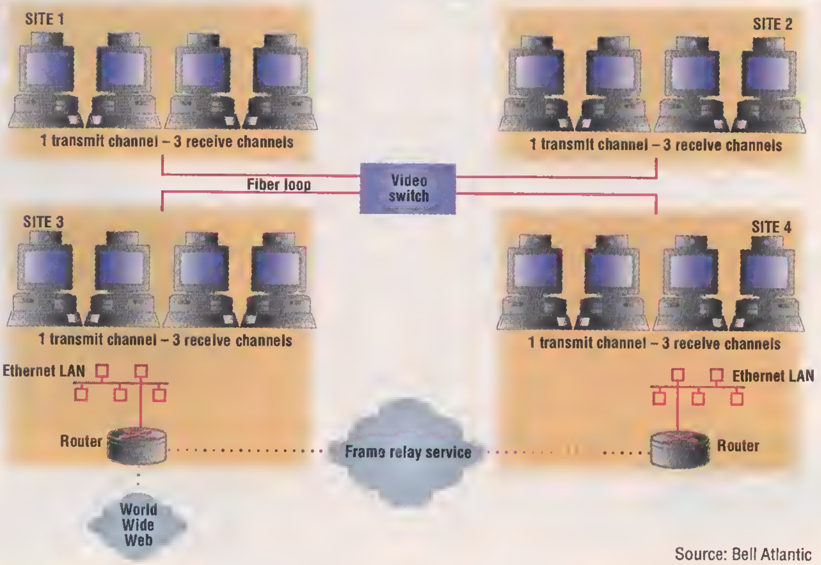
Because ISDN service is not line-powered (meaning customers having only an ISDN line would lack phone service during a power outage), SBC and Bell Atlantic usually provide ISDN to subscribers through a second line. However, new ISDN-over-POTS technology ("Pulling bandwidth out of a copper hat," July 15, 1997), provisions a line-powered ISDN POTS line, enabling the RBOCs to deploy ISDN on a subscriber's existing line. SBC and Bell Atlantic are considering the technology.

"We have scarce facilities in the South San Francisco Bay area, San Jose and Silicon Valley because we've had so much growth in those areas," Hernandez explains. Also, "if the technology pans out, we can craft new services or re-price existing services. If someone were contemplating an additional line, we could offer them ISDN at a comparable price."

The growth in ISDN BRI has been accompanied by growth in PRI lines. The PRIs collect traffic from telecommuters' BRIs, eliminating the need for cumbersome modem pools managed by beleaguered MIS managers to accommodate offsite workers connecting via modem to corporate local area networks.

SBC supports Always On/Dynamic ISDN (AO/DI), which provides subscribers with constant connectivity to their server or Internet service provider (ISP) via ISDN's 9.6 kbps D-channel and dials up additional B-channels when something

Figure 1: Bell Atlantic Video Services distance learning architecture


SITE 1
SITE 2
1 transmit channel – 3 receive channels
1 transmit channel – 3 receive channels
Fiber loop
Video switch
SITE 3
SITE 4
1 transmit channel – 3 receive channels
1 transmit channel – 3 receive channels
Ethernet LAN
Ethernet LAN
Router
Frame relay service
Router
World Wide Web

Source: Bell Atlantic

larger than a brief e-mail is sent or received ("Generation gaps," Oct. 15, 1997). Telecommuters do not have to dial up a connection every time they want to send or receive a file. AO/DI allows teleworkers and local exchange carriers (LECs) to use network resources more judiciously and cost-effectively. Bell Atlantic plans to launch AO/DI trials this quarter, but is still evaluating the technology for viability, as the RBOC would have to change existing packet data network tariffs to offer the service cost-effectively, Pizzirani says.

ABC'S SWEEPING DOWN THE PLAIN

Oklahoma's Panhandle Telephone Cooperative Inc. began its distance learning project in 1988 to save the towns in its region from disappearing into a black hole when the oil, gas, and farming sectors took a nosedive and the towns were receiving more mandated education requirements (and less revenues) from the state. "The schools were looking for ways to satisfy the mandates and do so on less money," recalls Ron Strecker, chief executive officer at Panhandle.

The LEC hooked up four K-12 schools in Beaver County via private DS3 (45 Mbps) lines. Each school had three DS3s that linked to video codecs on their premises. Grant money was given to the schools to purchase the equipment.

Soon, schools in other counties wanted the same capabilities. So, 12 high schools as well as Oklahoma Panhandle State University were added to the private network. In 1995, the schools replaced their old codecs with Grass Valley codecs, which allowed them to receive three channels per DS3 instead of the one channel per DS3. Panhandle also added a Grass Valley video switch to its network. Finally, each school could communicate dynamically with three other schools on the Interactive TV (ITV) Network, according to Strecker.

In 1997, ITV was linked to the state's OneNet network that connects schools, libraries and government agencies. Because the state requires those connected to OneNet to use compatible codecs, Panhandle schools now can access all other schools in the state. "We lease our facilities to OneNet and OneNet contracts services to the schools," Strecker explains. Internet access is provided via overhead bandwidth on the circuits that Panhandle Telephone leases to OneNet.

The distance learning project also helped Panhandle justify upgrading its interoffice trunk network to fiber. Each school is connected to a central office (CO) via a discounted fiber link, the longest of which is 2 miles long. The schools have full-mesh connectivity via the fiber that connects the COs.

"We provided the lines at or below our cost, because we are a cooperative. Our members have school-aged kids. Some of the schools were on the verge of closing. We helped them keep their doors open which, in turn, helped the town stay in existence," Strecker notes.

YES, VIRGINIA, THERE IS DISTANCE LEARNING

Bell Atlantic's Network Virginia distance learning project has resulted in a OC3c asynchronous transfer mode (ATM) backbone that connects Virginia's schools and universities with video access to one another and Internet access, according to Ray Beers, director of data strategy and remote LAN access.

Bell Atlantic and eight Independent LECs provide schools with access to the ATM backbone via an ATM user to network interface (UNI) at the same rate—key to the success of the project, Beers says. Internet traffic is handed off to several ISPs at a 'gigapop' at Virginia Tech (Blacksburg, Va.).

Network Virginia has added eight Ascend 500 ATM switches to Bell Atlantic's network. The initiative has realized a working ATM network ahead of schedule for the RBOC and has brought ATM to places that never would have seen such connectivity were it not for distance learning.

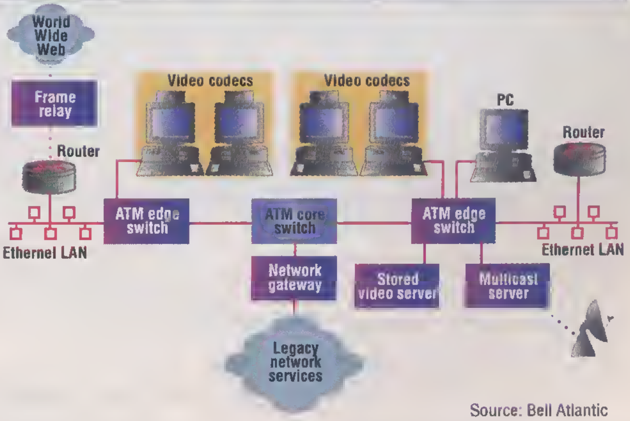
"ATM is now deployed in every [local area transport area] in Virginia," Beers says. "The distance learning application also demanded that we make switched virtual circuit [SVC] service available. We still haven't offered SVC service publicly, but when we do, we will have lots of experience and knowledge of what it takes to run an SVC network."

The next step is to provide on-campus and close-to-campus facilities with backbone access via digital subscriber line (xDSL) technology, Beers says. "We've been involved in a few trials now and the results have all been positive," but the RBOC has not yet determined how to price the service.

Bell Atlantic has about 500 distance learning sites regionwide that use a non-ATM, video-only platform (Figure 1). Sites for the Multichannel Video Service (Bell Atlantic North) and Interactive Distance Learning Service (Bell Atlantic South) are connected to each other via 10 Mbps channels gleaned from DS3 lines, which connect to Tektronix video switches, according to Mike Volgende, director of video service and data sales support for Bell Atlantic. Most sites are set up to transmit one signal and receive three simultaneously. "As such, it's been pretty successful," he says.

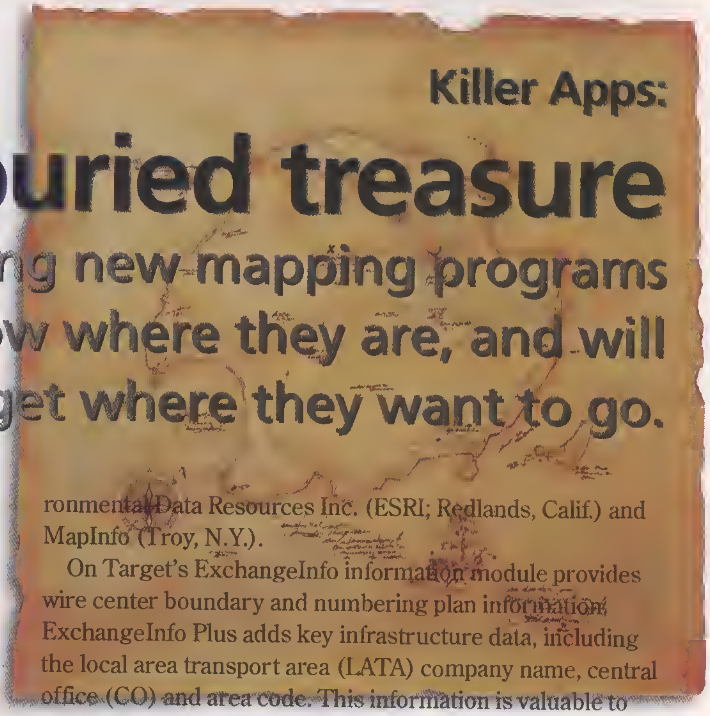
The next phase of Bell Atlantic's distance-learning agenda is to place services on an ATM SVC platform (Figure 2) such as that used in Network Virginia. "SVCs will give schools the ability to place calls from anywhere to anywhere, and to integrate multiple services on a more open, standard platform," Volgende says. "The whole paradigm of video services is changing; they are evolving from a dedicated, isolated service to one that is integrated with more common data and voice services." ■

Figure 2: Emerging broadband video service architecture



Source: Bell Atlantic

ANNIE LINDSTROM



Killer Apps:

Finding buried treasure

Carriers using new mapping programs will know where they are, and will get where they want to go.

Plotting the future, strategically and tactically, has never been more complex or important. Vendors of network mapping, design and inventory software are delivering the tools carriers can use to design competitive networks, and roll out new services—such as digital subscriber line (xDSL)—as well as mature ones—such as integrated services digital network (ISDN)—with ease and aplomb.

Rolling out ADSL and ISDN in areas where uptake is likely, plant is qualified and network facilities are in place will be easier for carriers that have documented what's in their networks, their technician's trucks and supply depots, and have plotted where those resources are in relation to potential users.

Over the last 18 months, developers of desktop geographic information systems (GIS) have teamed with content providers and application developers to bring a host of solutions to market. The beauty of these solutions is that all carrier employees can look at their networks in relation to demographic, cartographic, topological and engineering data; that information no longer is accessible only to the select few who know how to read a computer aided design (CAD) drawing or have access to a specific database. Moreover, different information modules can be sandwiched together as needed to answer specific questions.

For example, a service provider using a GIS system to document access lines that have been qualified to provide ISDN can share that information with customer service representatives. Reps could consult a color-coded map (which tells them how long it's likely to take the company to install an ISDN line for a particular customer) by calling up that customer's geocoded coordinates and matching the residence or business to a pinpoint on the map.

BURIED TREASURE

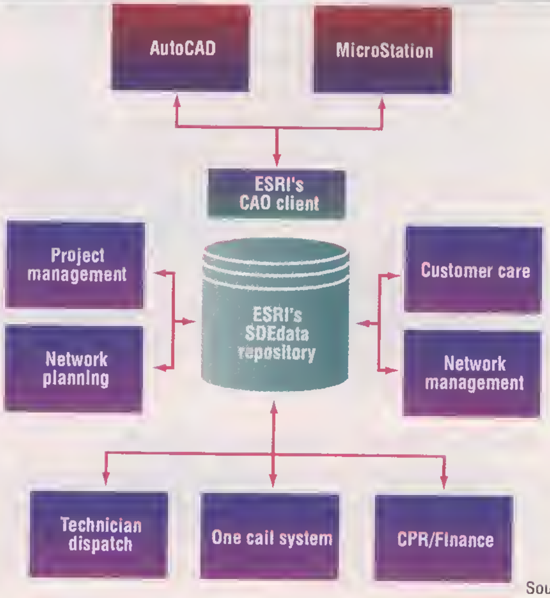
Much of the information service providers need to access is buried in their legacy systems, such as Bellcore's Trunk Integrated Record Keeping System (TIRKS) or in CAD drawings. Third-party content providers such as On Target Mapping (Pittsburgh) and the United States Geographical Survey (USGS) also provide useful information for wireline and wireless service providers, as well as GIS developers such as Environmental Data Resources Inc. (ESRI; Redlands, Calif.) and MapInfo (Troy, N.Y.).

On Target's ExchangeInfo information module provides wire center boundary and numbering plan information; ExchangeInfo Plus adds key infrastructure data, including the local area transport area (LATA) company name, central office (CO) and area code. This information is valuable to competitive local exchange carriers (CLECs) that are building facilities-based networks as well as to incumbent local exchange carriers (ILECs) looking to offer services outside of their regions—or, perhaps, to those trying to pinpoint their own network's weaknesses as competitors advance on their territories.

"The data tells them where they can most cost-effectively place a facility and reach the most people," says Jay Smetanka, product specialist for On Target.

A product called ContourInfo helps service providers get "the lay of the land," so they can evaluate the appropriateness of a site for residential or commercial development or for the placement of a wireless tower. Combined with ObstacleInfo

Figure 1: CAD/GIS database integration



Source: ESRI

CAN YOU MAKE THE CUT?
THIS WINTER, WE'RE INTRODUCING NEW WAYS TO CUT THE COST OF DELIVERING SERVICES TO YOUR CUSTOMERS. SEE A SNEAK PREVIEW ON OUR WEBSITE.

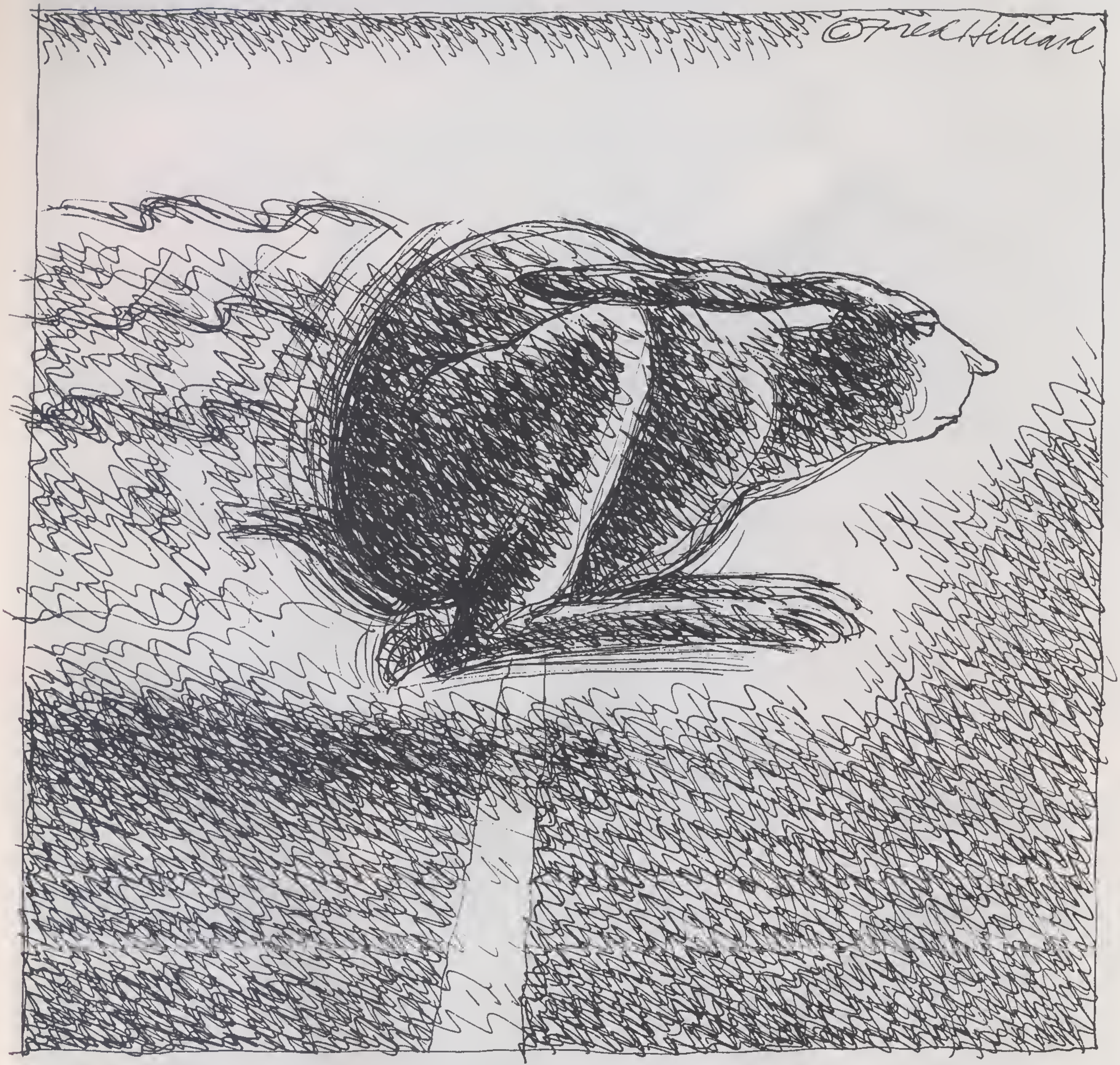
www.telco.com

Circle 112

Come see us at ComNet booth #1346.

Telco Systems

WillTales



Conventional wisdom aside, that Williams network wants you to know that fast and steady beats slow and steady every time in the real world.

That Williams network is back, quickly building a reputation as the steady alternative in the wholesale marketplace. With thousands of fiber miles already laid, lit and ready to ride. With the most advanced ATM network in communications history. With superior support services, including systems and network design, architecture planning and implementation — as much or as little as you need. With unequalled experience in the wholesale marketplace as a partner. Not a competitor.

And most importantly, with those Williams networkers. The folks that made that first Williams network a legend are now making that new Williams network a leader.

those**Williams**networkers℠

11,000 fiber miles laid, lit and ready to ride.

In a hurry? Visit **www.willtales.com** or call **1-800-WILLIAMS.** ©1998 The Williams Companies, Inc.

Circle 113

and FAAInfo, service providers can slash the amount of time they have to spend in the field as well as the paperwork they would have had to plow through to do the job properly, Smetanka says.

Some applications allow LECs to digitize their network facilities into a database.

In addition to making mapping information available enterprise-wide, mapping software vendors also have linked their products to spatial data in relational databases and to automated business process solutions. In October, ESRI introduced an interface allowing service providers to integrate ESRI mapping software with SAP's R/3 materials management and maintenance client-server business applications solution. The interface enables ESRI mapping software and a carrier's SAP-based inventory system to "become one" by establishing a link between ducts, poles and pedestals and their place in the inventory/management system, says Kees Van Loo, telecom industry manager for ESRI. Carriers can count what's in stock and where it is as well as what's ordered and what it costs them, simply by clicking on an icon.

It's comparable to bar-coding pricing and inventory information at a supermarket. Items entered into a cash register are added to the customer's bill, and deducted from the store's inventory system.

Some LECs are ready to begin integrating their SAP systems with ESRI's SDE spatial database engine, according to the developer. SDE is a client-server product storing geographic information in industry-standard database formats such as Oracle, Informix and Sybase. "We also have routing tools that solve the problem of where to send which technician and in what order, which also can be integrated with SAP-based customer care systems," Van Loo adds.

ESRI also has CAD Client (Figure 1), which allows LECs to store CAD features in industry standard database formats, allowing them to integrate CAD and GIS databases. "Lots of telcos have two separate databases that are redundant, and it is hard to exchange data between them," Van Loo explains.

According to Tom Holec, telecom industry manager for MapInfo, being able to store mapping information in relational databases has given service providers the ability to:

- Optimize network design and upgrades;
- Determine access to targeted customers;
- Respond to competitive threats; and
- Interrelate outside plant information with sales and marketing data.

In 1997, MapInfo rolled out SpatialWare, which also offers users a spatial extension to industry-standard relational databases. The ability to access information from a relational database adds intelligence to the icons, allowing service providers to build their networks intelligently.

"We worked with a client that had built several Sonet [synchronous optical network] rings, only to find that they had no clients near the rings; they did not know how to relate customer information to information on a map," Holec says. "All the old systems that RBOCs [regional Bell operating companies] have used in the past are not relational, they are flat files. The way the Bell System was built, the telcos have no way of knowing how many circuits they have going into any given location. Taking inventory is very klugey."

Some LECs dump information from TIRKS into their GIS systems, while others have to start from square one, he adds. They may have a good idea of where a circuit begins and ends, but they likely do not know where it goes in-between.

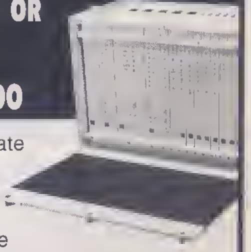
Today, a carrier can hire programmers to design an application that would allow the company to digitize its network facilities into a database. Alternatively, it could buy an off-the- shelf application such as a network engineering application developed by MapInfo and its partners Advanced Fiber Optics (Provo, Utah) and Network Design House (Oxford, England) that may do most of what the LEC needs and require little customization, Holec explains.

MAKING IT WORK

Companies that are most successful in using combined GIS/relational database systems have a server librarian or database administrator in charge of organizing the data that can be accessed. A list of what's on the server, its source and age, when it was last updated, and whom to contact regarding that information is a nice feature to have, Holec says.

It's clear that, in 1998, service providers wishing to develop winning strategies, and design and deploy network facilities will have more information than ever before at their disposal. Those who crunch their data using modern mapping tools that link to relational databases and enterprise-wide automated business processes likely will have the upper hand. ■

SYNCHRONIZATION TIMING SYSTEM
STRATUM 1, 2 OR STRATUM 3E
MODEL STS 5400



- Public and Private Network Configurations
- DS1 Framed Ones, Composite Clock 64/8 kHz, 2.048 MHz Square Wave & E1 Framed Ones Outputs
- Automatic DS1 to E1 Input Translation
- Redundant Power Feeds
- Eliminates Jitter and Wander
- Digital Synthesizer for Stratum 1, 2 or 3E
- Hitless Switching Between Inputs
- TL1 Network Management
- Menu Network Management
- Bellcore, AT&T & CCITT Compatible
- NMA, SONET and SYNTRAN Timing Reference Compatible

ISO 9002

www.laruscorp.com
Call Larus
800/999-9946
Larus Corporation
1560 Berger Dr. • San Jose, CA 95112

Circle # 111

DAVID KOPF

Killer Apps:

Cheap alternatives

VPN, voice/IP can make profit sheets sing.

AS WE REV UP 1998'S TECHNOLOGY ENGINES, INTERNET SERVICE PROVIDERS (ISPS) HAVE MUCH TO ANTICIPATE—FOR THE FOCUS HAS MOVED FROM SERVING THE MEAGER RESIDENTIAL ACCESS MARKET TOWARD THE MORE PROFITABLE BUSINESS SECTOR.

Two standout business applications ISPs began offering in 1997 were virtual private network (VPN) services over the public Internet, and voice and fax-over the Internet (voice/IP and fax/IP). Both are cheap alternatives to similar applications run over more costly leased-line services such as frame relay.

Secure VPN services running over the Internet relieve businesses from shelling out big bucks for private network services. This market has been irresistible to the likes of AT&T WorldNet (Basking Ridge, N.J.), internetMCI (Washington) and TCG CERFnet (San Diego), which opened up secure VPN services last year. To prove their commitment, ISPs also started nailing down service level agreements, or at least reasonable facsimiles. For example, AT&T WorldNet debuted Virtual Private Network Service with end-to-end service guarantees over a backbone designed to offer 99.7% reliability, and 150 millisecond latency between two AT&T-managed customer sites.

Voice/IP and fax/IP applications also debuted last year, providing business customers with another strong argument for taking critical telecom and data communications to the Internet rather than to leased networks.

VOICE, FAX OVER THE 'NET

Although in 1996 we saw PC-based client software that could let online users talk to one another from their desktop computers, it was 1997's commercial use of voice/IP gateways that made the technology viable, mainly because users didn't need computers to use it. In a basic voice/IP gateway network architecture, users dial into a voice/IP gateway residing at an ISP's point of presence (POP), where they are greeted by an interactive voice response (IVR) prompt asking them to enter the number they want to reach. The gateway then finds the gateway at the POP nearest to the phone number the user wants to reach, and connects to it. The remote gateway then outdials to the intended recipient.

The more aggressive offerings came from regional players, tailoring services for point-to-point niche markets, such as New York to Europe or Los Angeles to Hong Kong. Fax/IP made the largest gains. PSI Net (Herndon, Va.) debuted worldwide InternetPaper fax/IP services, and UUNet Technologies (Fairfax, Va.) rolled out UUFax services to the U.S., Europe and Asia. For voice/IP, one 800-pound gorilla was Qwest Communications Inc. (Denver), which bellowed IP-based long distance to selected cities in California, Colorado, Kansas and Utah.

Most researchers predict a good number of users plan to use voice/IP. In a Business Research Group (Newton, Mass.) study of 117 users (of which 109 answered, 65% IS/MIS personnel), 19% plan to implement voice mail over the Internet, 19% plan to implement live calls, and 23% are studying it.

If subscribers make good on their plans, they could draw enough traffic from the public switched telephone network to cost local exchange carriers up to $8 billion worldwide over the next four years, according to Action Information Services (Washington). According to Frost & Sullivan's (Mountain View, Calif.) "World Market for Internet & intranet Telephony" report, the total 1996 Internet telephony market reached 19.8 million, with revenues expected to grow at a compound annual growth rate of 149%, to $1.89 billion by the end of 2001.

WHAT TO EXPECT

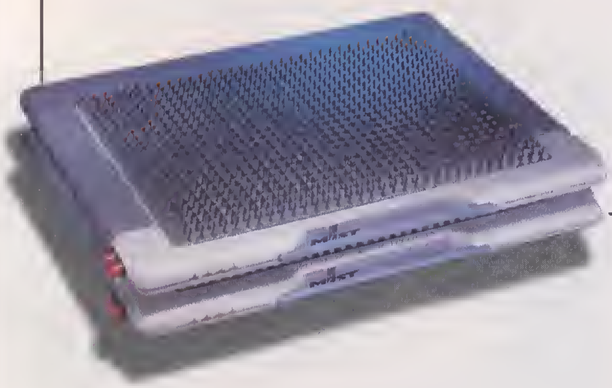
All that H.323 compliance isn't built into the various vendors' systems for naught. The big payoff for ISPs *cum* telcos will emerge as ISPs begin peering voice/IP and fax/IP gateways, which will call for arranging interconnection/roaming agreements that address all the billing, service and network management issues that come with telephony territory.

This year also will see further evolution in ISPs' business offerings. As technologies like resource reservation protocol (RSVP) and other quality of service (QoS) schemes evolve, and Internet roaming and IP multicasting are more widely deployed, businesses will have a wide range of services and applications from which to choose. ProVision service from GTE Internetworking (Cambridge, Mass.) offers multicasting and QoS for applications such as distance learning. If such offerings are married with 1997's VPN and voice/IP applications, 1998 could be a banner year for the Internet providers. ■

Are you using the right tool for your handoff?

■ Trying to connect your SONET network to an asynchronous DS1/DS3 handoff used to be a costly proposition. Now Positron MIST™ hands you the right tool. It provides SONET EC1 to DS3 transmultiplexing in a single cost-effective package, while improving your service to customers by giving you full SONET and DS1/ESF Performance Monitoring right to your network's edge. ■ For DS1 delivery applications, MIST also reduces your service deployment costs by providing DS1 connections direct from your SONET transport network without the need for expensive, low speed multiplexer shelves. ■ To find out how Positron Fiber Systems can provide you with the right tool for your broadband access networks, call us at 609-222-1288 or e-mail us at sales@positronfiber.com.

Positron MIST™ is the cost-effective SONET connection.



POSITRON FIBER SYSTEMS

SONET Access Made Simple

www.positronfiber.com

Circle 114

Some Choices Are Obvious.

Why invest in multiple test sets and analyzers when a single, portable unit does everything they can do, and more, for a fraction of the cost?

With the Sunset™ T10, you'll get the functionality of as many as seven separate test sets in a convenient hand-held package. All the standards and features you need most are there, from ISDN Primary Rate Interface and full duplex T1 drop-and-insert through datacom transmission testing and SS7 message monitoring and analysis. Field upgrades are a snap using SunWare™ cartridges: just insert the card and your new capabilities are ready to use in seconds. The SunSet T10 is simple to use, too, with a large backlit display for circuit graphics and LED indicators for at-a-glance signal status information.

And the budget you set aside for all those separate, stand-alone testers can instead equip your entire staff with these extensive and powerful capabilities, in a go-anywhere package.

See for yourself why carriers the world over rely on Sunrise Telecom to keep them a step ahead. Call us today for more information and a demonstration of the SunSet T10. You'll be impressed with how it stacks up against the competition.

SUNRISE TELECOM
INCORPORATED

. . . a step ahead

22 Great Oaks Boulevard, San Jose, CA 95119 U.S.A.
408-363-8000 FAX 408-363-8313
Internet: support@sunrisetel.com

Circle 115

SunSet and SunWare are trademarks of Sunrise Telecom, Inc. Specifications subject to change without notice. A115

DEBBIE L. SKLAR

TELEPHONE HEADS NORTH

RECALL

FROM THE AMERICA'S NETWORK ARCHIVES

Thirty-three years after Salomon-August Andree and two companions flew into oblivion over the Arctic seas in a huge balloon, the gruesome tale of their battle with the elements was partially revealed through the finding of their bodies and equipment on White Island.

Undoubtedly, the preparations for the expedition were carefully made and their last communication to the world—"good journey northward"—was brought back to civilization by a carrier-pigeon.

There was a vivid contrast between the Andree method of communication and the Byrd Antarctic Expedition. Commander Byrd reported his reliable telephone communication at the South Pole played a great part in the success of his expedition. The extreme weather conditions at the pole and the hard usage to which their telephone equipment was subjected was a test without parallel. Yet, his telephone gave a fool-proof service, when required.

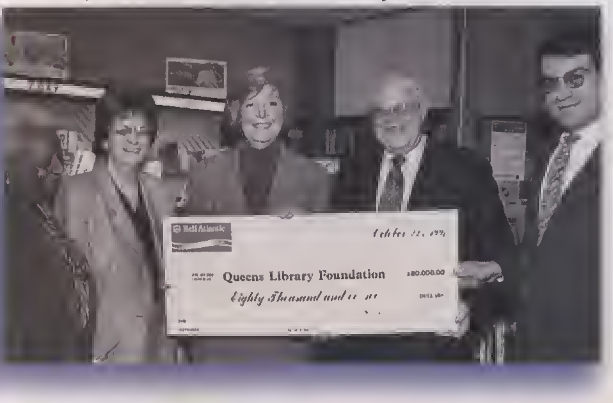
In a September 1930 article about the journey, *Telephone Engineer* said, "We give the highest praise to these aerial pioneers and believe that the disaster which befell Andree's venture might have been averted had the radio and telephone been available to him as it was to Commander Byrd. Swift and sure communication could have called ships to his aid."

Either that or they should have tried to get in touch with Santa.

Catching the computer literacy bug

A check for a whopping $80,000 was presented to the Queens Borough Public Library last October to help fund an innovative program to help library customers become more computer literate. The program called "Teen 'Net Mentors" also will provide jobs for many local teens. They give one-on-one assistance to customers searching for information in the library's catalog, its databases and on the Internet. The check, presented by Bell Atlantic vice president Alana Kennedy at the Rochdale Village branch, is the single largest grant the Bell Atlantic Foundation has given to date in Queens. The library serves a population of 2 million in the most ethnically diverse county in the country. In 1997 the library had 15.5 million items in circulation, the highest circulation of any library system in the United States.

L to R: Evelyn Whittington of Rep. Floyd Flake's staff; Alexandra Rosa, chief of staff in Queens borough president Shulman's office; Alana Kennedy, vice president of Bell Atlantic; Queens Library director Gary E. Strong; and Stanley Gornish, executive director of the Queens Library Foundation.



Sound bytes

USTA SOUNDS OFF TO AT&T

The following statement is attributed to Roy Neel, president and chief executive officer of the United States Telephone Association. He was responding to AT&T's decision to pull away from local service.

"It is a shame that a powerhouse like AT&T has to continue to use the local telephone companies as scape goats to save itself from bad days on Wall Street. From the beginning it has been obvious that AT&T and MCI have little interest in competing fairly for the local customer. The fact is that AT&T has little commitment to offering local telephone service other than to high volume businesses where the financial returns are great. You can bet that when the first Bell Company is approved to offer long distance service to customers in its region, AT&T will reach out and try to touch a few more local telephone customers."

Pictures are worth a thousand words

Ameritech is offering a unique co-branded card that doubles as a birth announcement for new parents. It's a concept that could rival the age-old tradition of passing out cigars by new fathers.

Ameritech and the Texas-based Sportscall LLC have launched the family memories phone card, initially targeting new parents. Soon to be available in more than 3,900 hospitals in 50 states and now available by phone, new parents can send family and friends free phone time on a card bearing the kid's mug. Call 888/243-1033 to order.

DEBBIE L. SKLAR

Ethernet technology establishes new standards

The Fast EtherRing Switch allows data to be transmitted over fiber rings in native Ethernet format. Costs are potentially less than for networks implemented using other packet-based transmission formats. The switch allows high-speed, high-capacity transport of data, IP-video and IP-voice over telephony, and MPEG digital voice over fiber optic rings of virtually unlimited distances. Using the switch for high-speed data transmission eliminates the need for distributed routers and central switches, reducing the number of packet conversion points in the MAN. The switch initially uses a dedicated fiber or works in conjunction with the company's DV6000 high-speed digital transport system.

solutions

Data communications industry experts who have reviewed the product report Ethernet technology will allow regional networks to be implemented over a dedicated fiber with possible equipment cost savings of 50% to 80% over ATM/Sonet-based systems. The switch also allows Ethernet capacity to be expanded incrementally from 200 million Mbps to 16 million Gbps, equivalent to OC-288 data rate over a single fiber.

The Ethernet format has been limited to short distance, star-based networks, such as LANs. For longer distance transmission of high-speed data over public and private networks, data currently must be converted to frame relay, ATM or other formats. These data conversions add costs to the network in two ways:

- The cost of conversion equipment, including routers and switches at each local site and central switches; and
- The loss of transmission capacity across the entire backbone network, due to higher overhead and lower transmission efficiency of the converted data formats.

The switch consolidates routing and provides distributed switches in place of hubs, carrying packets in the MAN ring in the less expensive Ethernet format. It makes all Ethernet MANs possible by using the native Ethernet transmission protocol over a dedicated fiber and inexpensive EtherRing switches at each remote node, instead of other packet formats requiring complex, expensive and maintenance-intensive distributed routers at all remote nodes.

CATV operators will be able to establish Ethernet networks that deliver multiple IP-based services to business and homes. The switch allows IP data and video signals to be transmitted to and from multiple hubs across regions without installation of expensive routing equipment, reducing the delivery cost to network services to area businesses.

The switch consists of hardware and software for transporting digital signals, Ethernet interfaces, switching components, and related operational and network management software.

ADC Telecommunications Inc. (Minneapolis)

Visit www.adc.com or Circle 250

Internet Solutions

Next-generation Internet security

By separating the fundamental security function (performed on its firewall) from the centralized management function, (performed by its security management software) the Lucent Managed Firewall provides a scalable approach to firewalls. This distributed network approach enables users to administer security easily throughout their entire network. Firewall users can cost-effectively provide distributed security for Internet, intranet and business-to-business communications such as Virtual Private Networks.

The firewall can replace or complement any available Internet firewall and can support a variety of applications without requiring network reconfiguration.

Pricing for the managed firewall begins at $15,995.

Lucent Technologies (Murray Hill, N.J.)

Visit www.lucent.com or Circle 252

Information starts here!

To receive FREE information on products and services advertised in this issue, circle the appropriate numbers below.

Do you wish to receive (continue to receive) *America's Network* FREE of charge? ☐ Yes ☐ No

SIGNATURE ______________________ DATE ________

NAME ______________________ TITLE ______________________

COMPANY ______________________

DELIVERY ADDRESS ______________________

CITY ______________________ STATE/PROVINCE ______________________

ZIP/POSTCODE ______________________ COUNTRY ______________________

PHONE ______________________ FAX ______________________

INTERNET/E-MAIL ______________________

To qualify for your FREE subscription, you must answer these FOUR questions: *(Fill in oval completely, as shown: ●)*

1. What is the primary business activity of your firm? *(Fill in **ONE** only.)*

1 ○ 100 Telecommunications Carrier/Network Service Provider/Holding Co.
2 ○ 525 Utility
3 ○ 575 Computer Service Firm/Software Developer or Other Computer/Electronic-Related Industries
4 ○ 145 Telecommunications Consulting/Engineering Co.
5 ○ 135 Construction Contractor
6 ○ 152 Telecommunications Equipment Vendor, Reseller, VAR or Distributor
7 ○ 500 Finance/Investment/Banking
8 ○ 600 Corporate/Private/Government Telecommunications User
9 ○ 625 Association
10 ○ 400 Other ______________________ *(please specify)*

We reserve the right to reject any incomplete or unqualified requests.

2. Which of the following services does your co. provide? *(Fill in **ALL** that apply.)*

11 ○ A Interexchange Carrier/Long-Distance Service Provider
12 ○ B Local Exchange Carrier
13 ○ C Cellular Carrier
14 ○ D PCS Operator
15 ○ E Paging & Message
16 ○ F Satellite Communications
17 ○ G Other Wireless Operator
18 ○ H MSO (Two or more Cable TV Systems)
19 ○ I Independent Cable TV System
20 ○ J Cable TV Contractor/Engineering Firm
21 ○ K Other Cable
22 ○ L Competitive Access Provider (CAP)
23 ○ M Telecommunications Reseller
24 ○ N Internet Service Provider/Commercial Online Service Co.
25 ○ O Systems Integration/Outsourcing
26 ○ P Other Carrier
27 ○ Q OTHER ______________________ *(please specify)*

Free subscription offer valid in the U.S. and its possessions only. Canada/Mexico (24 issues) $95. All other countries (24 issues) $115. ☐ Add $90 per order for airmail delivery. Payable in U.S. dollars drawn on a U.S. bank.

Fast Action FAX: 1-413-637-4343

3. Which of the following describes your title classification? *(Fill in **ONE** only.)*

28 ○ 11 **Technical Mgmt.** (Engineering VP, Director or Mgr.; Technical VP, Director or Mgr.; Network VP, Director or Mgr.; Plant Mgr.)
29 ○ 12 **Engineering** (Network Designer, Engineer, Technician)
30 ○ 25 **Data Communications/Digital/IS/MIS Mgmt.** (Data Communications, Digital, I/S VP, Director or Mgr.)
31 ○ 13 **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
32 ○ 3 **Corporate Mgmt.** (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
33 ○ 4 **Legal, Financial, Regulatory or Processing Services** (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
34 ○ 5 **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
35 ○ 16 **Sales/Marketing** (Sales or Marketing VP, Director, Mgr., Representative)
36 ○ 20 **Purchasing** (Purchasing, Materials, Contract VP, Director or Mgr.)
37 ○ 7 **Other** (Co. Copies and Other Titled and Non-Titled Personnel)

America's Network

100	101	102	103	104	**105**	106	107	108	109	**110**	111	112
113	**114**	115	116	117	118	**119**	120	121	122	123	**124**	125
126	127	**128**	129	130	131	132	**133**	134	135	136	137	**138**
139	140	141	**142**	143	144	145	146	**147**	148	149	**150**	151
152	153	154	155	**156**	157	158	159	160	**161**	162	163	164
165	166	167	168	169	**170**	171	172	173	174	**175**	176	177
178	**179**	180	181	182	183	**184**	185	186	187	188	**189**	190
191	192	**193**	194	195	196	197	**198**	199	200	201	202	**203**
204	205	206	**207**	208	209	210	211	**212**	213	214	215	216
217	218	219	220	**221**	222	223	224	225	**226**	227	228	229
230	231	232	233	234	**235**	236	237	238	239	**240**	241	242
243	**244**	245	246	247	248	**249**	250	251	252	253	**254**	255
256	257	**258**	259	260	261	262	**263**	264	265	266	267	**268**
269	270	271	**272**	273	274	275	276	**277**	278	279	280	281
282	283	284	285	**286**	287	288	289	290	**291**	292	293	294
295	296	297	298	299	**300**	301	302	303	304	**305**	306	307

4. Which of the follow equipment/services do you purchase, recommend, specify, approve or otherwise influence the purchase of? *(Fill in **ALL** that apply.)*

38 ○ A **Wireless/Cellular/Mobile/PCS Equip./Services**
39 ○ B **Central Office Equip./Services** (CO Switching Equip. [digital, ATM], Programmable Switches, Operations Support Systems, Workstations, CO Test, Hardware, Frames)
40 ○ C **Transmission and Broadband Distribution Equip./Services** (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
41 ○ D **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
42 ○ E **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
43 ○ F **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
44 ○ G **Data Communications/MIS/Network Mgmt. Support Equip./ Services** (including LANs, WANs, & Network Software)
45 ○ H **Power & Protection**
46 ○ I **Test & Measurement**
47 ○ J **Other** *(please specify)* ______________________
48 ○ K None of the Above (A–J)

This card is good for 3 months from date of issue.
JANUARY 15, 1998 2

---

presence (POP), access using a third party POP, and LAN access from work locations.

- Subscriber Information Manager—This includes a set of Web and Java-based applications for customer service representatives and system administrators to search and update subscriber information and system parameters efficiently. In addition, a set of Web-based, self-care applications improve customer service and reduce ISP customer care costs.
- Content Personalization Manager—This "intelligent agent" allows ISPs to provide profile-based content, including personalized news and stock quotes, and content on local events, restaurants, maps and movies.
- Subscriber Activity Manager—A set of data collection and reporting tools that track member activity.
- Subscriber Notification Manager—ISPs can provide members with automatic notification of various events, including friends joining the network, arrival of new mail, stock price and sports score updates, and newsgroup postings.

International Business Machines Corp. (White Plains, N.Y.)

Visit www.ibm.com/isp or Circle 251

IP multiplexer

Many companies have existing networks that enable branches to communicate over an existing IP backbone, while their corporate headquarters may have a wide area network (WAN), such as the company intranet, that uses frame relay to provide voice, data and video service. Over the next few years, these two types of networks will be used in concert to provide a seamless calling environment.

The TIP-640 Internet Protocol Multiplexer offers the ability to use private networks to carry full duplex, long distance and fax calls within the network for a fraction of the price of long distance service.

The telephony-over-IP product is the first released under the company's commander platform, the Integrator 2000 for intranet communications.

Science Dynamics Corp. (Cherry Hill, N.J.)

Call 800/732-7466 or Circle 258

Circle # 116

INFORM ♦ INTRODUCE ♦ INFLUENCE ♦ INSTRUCT

CUSTOM REPRINTS

Reprints are highly effective when you use them to:

- Develop direct-mail campaigns
- Provide product/service literature
- Create trade show distribution materials
- Present information at conferences and seminars
- Train and educate key personnel, new hires
- Enhance press kits
- Compile reference materials
- Track trends and emerging technologies

America's Network

BRIAN KANABA
ADVANSTAR MARKETING SERVICES
1-800-225-4569 ext. 155
216-891-3155
Fax: 216-826-2865

NO POSTAGE
NECESSARY IF
MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO 950 PITTSFIELD MA

POSTAGE WILL BE PAID BY ADDRESSEE

America's Network
PO BOX 5100
PITTSFIELD MA 01203-9845
USA

Data communications industry experts who have reviewed the product report Ethernet technology will allow regional networks to be implemented over a dedicated fiber with possible equipment cost savings of 50% to 80% over ATM/Sonet-based systems. The switch also allows Ethernet capacity to be expanded incrementally from 200 million Mbps to 16 million Gbps, equivalent to OC-288 data rate over a single fiber.

The Ethernet format has been limited to short distance, star-based networks, such as LANs. For longer distance transmission of high-speed data over public and private networks, data currently must be converted to frame relay, ATM or other formats. These data conversions add costs to the network in two ways:

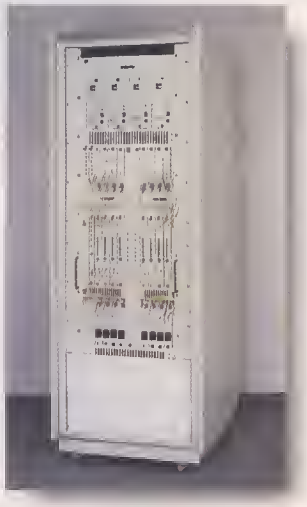
- The cost of conversion equipment, including routers and switches at each local site and central switches; and
- The loss of transmission capacity across the entire back-

and homes. The switch allows IP data and video signals to be transmitted to and from multiple hubs across regions without installation of expensive routing equipment, reducing the delivery cost to network services to area businesses.

The switch consists of hardware and software for transporting digital signals, Ethernet interfaces, switching components, and related operational and network management software.

ADC Telecommunications Inc. (Minneapolis)

Visit www.adc.com or Circle 250



Internet Solutions

Next-generation Internet security

By separating the fundamental security function (performed on its firewall) from the centralized management function, (performed by its security management software) the Lucent Managed Firewall provides a scalable approach to firewalls. This distributed network approach enables users to administer security easily throughout their entire network. Firewall users can cost-effectively provide distributed security for Internet, intranet and business-to-business communications such as Virtual Private Networks.

The firewall can replace or complement any available Internet firewall and can support a variety of applications without requiring network reconfiguration.

Pricing for the managed firewall begins at $15,995.

Lucent Technologies (Murray Hill, N.J.)

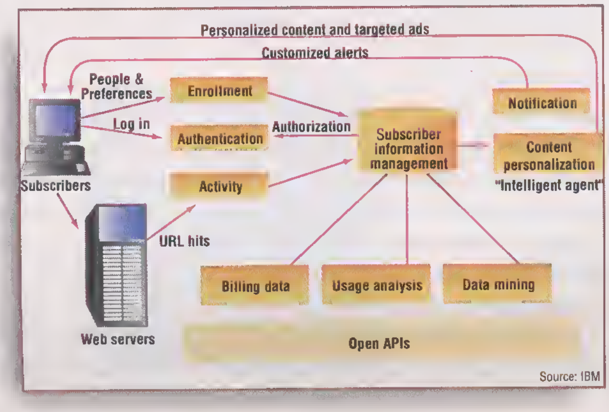
Visit www.lucent.com or Circle 252

Subscriber management system

The IBM Intelligent Management System provides the infrastructure for ISPs to enroll, authenticate and service their members. The system enables ISPs to offer customized, feature-rich environments, while preserving the flexible and open environment offered by Internet standards.

Features include:

- Subscriber Enrollment Manager— Allows ISPs to register members in an automated, operator-independent fashion, reducing customer service costs. It supports ISP branded CD-ROMs and diskettes containing client software, including a browser.
- Subscriber Authentication Manager—An authentication server based on RADIUS standards confirms subscriber log-ins and passwords. It supports a variety of methods for accessing ISP services, including direct dial-in using the ISP's point-of-presence (POP), access using a third party POP, and LAN access from work locations.



Source: IBM

- Subscriber Information Manager—This includes a set of Web and Java-based applications for customer service representatives and system administrators to search and update subscriber information and system parameters efficiently. In addition, a set of Web-based, self-care applications improve customer service and reduce ISP customer care costs.
- Content Personalization Manager—This "intelligent agent" allows ISPs to provide profile-based content, including personalized news and stock quotes, and content on local events, restaurants, maps and movies.
- Subscriber Activity Manager—A set of data collection and reporting tools that track member activity.
- Subscriber Notification Manager—ISPs can provide members with automatic notification of various events, including friends joining the network, arrival of new mail, stock price and sports score updates, and newsgroup postings.

International Business Machines Corp. (White Plains, N.Y.)

Visit www.ibm.com/isp or Circle 251

IP multiplexer

Many companies have existing networks that enable branches to communicate over an existing IP backbone, while their corporate headquarters may have a wide area network (WAN), such as the company intranet, that uses frame relay to provide voice, data and video service. Over the next few years, these two types of networks will be used in concert to provide a seamless calling environment.

The TIP-640 Internet Protocol Multiplexer offers the ability to use private networks to carry full duplex, long distance and fax calls within the network for a fraction of the price of long distance service.

The telephony-over-IP product is the first released under the company's commander platform, the Integrator 2000 for intranet communications.

Science Dynamics Corp. (Cherry Hill, N.J.)

Call 800/732-7466 or Circle 258

FEATURE ENHANCED AUTOMATIC PROTECTION SWITCH FOR ALCATEL SHELVES

MODEL B302L

The Larus B302L is plug interchangeable and a feature enhanced version of Lynch/Alcatel B302 switch cards. Designed to build out in-service Lynch/Alcatel Automatic Protection Switch shelves, the Larus B302L circuit card performs all Lynch/Alcatel card functions and offers the following enhancements:

- new transfer codes
- 0 to 655 feet of equalization in both directions
- separate AMI/B8ZS selection for equipment and facility
- immunity to hits after transfer
- recognition of AIS as a criteria for switching
- switch selectable disable of new features.

QUALITY ASSURED ISO 9002 LARUS

Call Larus
800/999-9946
www. laruscorp.com
Larus Corporation

1560 Berger Dr. • San Jose, CA 95112

Circle # 116

INFORM ◆ INTRODUCE ◆ INFLUENCE ◆ INSTRUCT

CUSTOM REPRINTS

Reprints are highly effective when you use them to:

- Develop direct-mail campaigns
- Provide product/service literature
- Create trade show distribution materials
- Present information at conferences and seminars
- Train and educate key personnel, new hires
- Enhance press kits
- Compile reference materials
- Track trends and emerging technologies

America's Network

BRIAN KANABA
ADVANSTAR MARKETING SERVICES
1-800-225-4569 ext. 155
216-891-3155
Fax: 216-826-2865

Internet Solutions
continued

Reliability improvements

SpeedServer and SpeedSeeker client-server software improves reliability of Web page delivery and speeds Web page delivery by an average of three times.

Features include:

- Streamlined handshaking—Sitara includes the file request with the initial connection request. Also, the "end of data" message is included with the final packet of data, closing down the connection more efficiently. These steps reduce overall transfer time.
- Efficient Loss Recovery—Packet loss rates from 5% to 15% are typical during busy network usage. The software resends only the lost data packet, speeding page delivery and reducing overall network congestion.
- Data consolidation—Sitara consolidates data transfers into a single, persistent connection, even when page elements are stored on separate servers.
- Control of network congestion and data flow—Currently, when Web servers receive a request for data, they reply by sending that data through a mechanism called "slow start," a geometrical rate of data transfer. The server doubles the amount it sends until there is packet loss, at which time the rate is cut in half. Although "slow start" is designed to prevent overloading data buffers, it confines data transfer rates and wastes costly bandwidth resources.

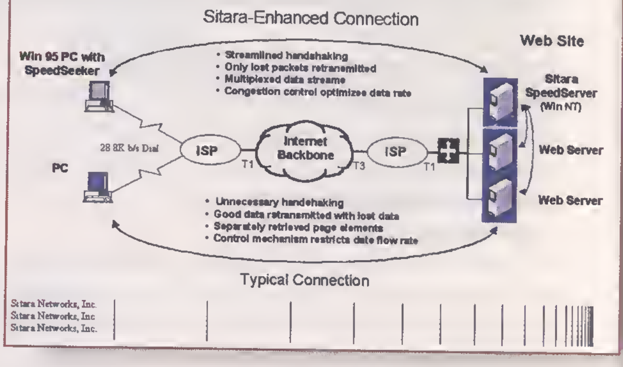
The product supports Microsoft NT 4.0 (service pack 3 recommended) operating system and requires a Pentium 200 MHz or faster processor, 128 MB of memory, a 1 GB or greater hard drive and a 10/100Mbps PCI Information Server. It is compatible with Netscape Enterprise Server 3.0, Microsoft Information Server and Apache Server 2.0 using HTTP 1.0 (HTTP 1.1 compatibility to follow).

Pricing is based on capacity and configuration of the Web site. For large installations, pricies begin at $75,000.

Sitara Networks (Waltham, Mass.)

Visit www.sitara.net or Circle 253

The Sitara Solution


Sitara-Enhanced Connection
Win 95 PC with SpeedSeeker
• Streamlined handshaking
• Only lost packets retransmitted
• Multiplexed data streams
• Congestion control optimizes data rate
Web Site
Sitara SpeedServer (Win NT)
28.8K b/s Dial
ISP
Internet Backbone
ISP
T1
T3
T1
Web Server
Web Server
PC
• Unnecessary handshaking
• Good data retransmitted with lost data
• Separately retrieved page elements
• Control mechanism restricts data flow rate
Typical Connection
Sitara Networks, Inc.
Sitara Networks, Inc
Sitara Networks, Inc.

America's Network

FAST ACTION POSTCARD DECK

A highly targeted and cost-efficient direct response card deck reaching over 50,000 decision makers throughout the new public network!

CONVENIENT & EASY TO USE— IDEAL FOR:

- Generating sales leads
- Testing product ideas
- Promoting new or existing products and services
- Distributing special offers
- Testing price points
- Inviting attendees to trade shows, seminars, conferences

America's Network handles all the details — printing, mailing and postage. Each card in the deck is self-contained, featuring your ad on one side and your business reply address on the other. Leads are mailed directly to you for immediate sales follow-up. It's that easy and convenient!

FAST ACTION POSTCARDS

Look Inside for Details!

For Complete Card Deck Information Contact:
DANIELLE GUNDLING, ADVANSTAR MARKETING SERVICES
1-800-225-4569 EXT. 153 ◆ 216-891-3153 ◆ FAX: 216-826-2865

DECK MAILS: MARCH ◆ MAY ◆ OCTOBER

Point-to-point communications software

Babylon provides complete functionality which previously was available only on dedicated network access routers and routing equipment. The software program features multilink and authentication on a workstation or server, making it suitable for ISPs and corporate enterprises requiring remote network access interoffice WAN communications and telework applications at 64 kbps.

The product is entirely device-independent, supporting inbound and outbound connections on a variety of media, including synchronous ISDN, asynchronous modems and direct connections. Each connection supports an unlimited number of independent lines. As many as 256 simultaneous connections can be active any time. Hardware censors can develop their own class drivers for use with Babylon using application programming interface specification. The software costs $199 for the 256 kbps version. CD-ROM copies also include the Red Hat Linux 4.2 operating system.

Spellcaster Telecommunications Inc. (Toronto)

Visit www.spellcast.com or Circle 255

T1 router streamlines remote connectivity

The Web Ranger is a compact T1/fractional T1 access router enabling ISPs and private network operators to set up fast and easy data and private branch exchange (PBX) connections to the Internet and intranets. The product saves channel service unit/data service units (CSU/DSU), routing and port extender costs by integrating all these capabilities into a single unit. ISPs and customers get instant LAN-to-WAN connectivity via IP networks using available T1, frame relay or PPP services.

The Web Ranger II features a single IP address, making the system economical for LAN use. A small- to medium-size office LAN can connect to the Internet/intranets using Web Ranger's single IP address from a central access router. It works with any standard router over PPP or RFC 1490 frame relay lines, eliminating the need for an CSU/DSU connected to the remote user router. The T1 interface is compatible with T1 services, supporting D4 and extended superframe format (ESF).

The 'Solid Firewall' feature will protect an office LAN from undesired entry from the Internet. Network managers can restrict access of file transfer protocol (FTP), simple mail transfer protocol (SMTP), Telenet and other TCP/IP services.

Rad Data Communications (Mahwah, N.J.)

Visit www.rad.com or Circle 254

PCS
HIDDEN ADVANTAGE

This UE Enclosure* is bigger than it looks. In fact, 40% of its useful capacity is hidden underground, so you can use standard racking while maintaining a low, unobtrusive profile.

Available in steel, aluminum or concrete, PSI's UE Enclosures are the ideal next-generation build-out solution.

PSI offers fast delivery on shelters and cabinets for telephone, PCS, cellular, and power distribution applications.

See us at *www.shelters.com.*

PSI
Professional Systems, Inc.
800/542-4422 P.O. Box 560, Hartland, WI 53029
Fax: 414/369-5205

* Patent No. 5315794

Circle # 117

Are you reading your own copy of *America's Network*? Call (800) 346-0085 Ext. 477.

America's Network

FT2ER QUAD T1
OPTICAL EXTENSIONS

THINKING ABOUT EXTENDING T1 OVER FIBER? TALK TO LARUS...

Larus FT2ER Quad DS1 Fiber Optic Extension System provides the most efficient and cost effective means of distributing T1 service to business parks, campuses and urban high rises.

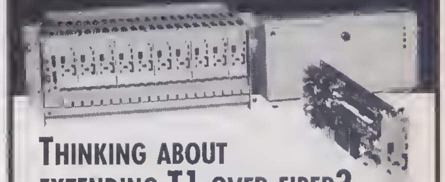
- 4 T1 Line Multiplexer
- Single Mode Fiber
- Multi Mode Fiber
- 1300 nM Laser
- Protected Fibers
- 30 dB Loss Budget
- Fiber Spans to 63 kM (37 mi)
- 48 V Power
- -40ºC to +75ºC

www.laruscorp.com

QUALITY ASSURED ISO 9002 LARUS

Call Larus
800/999-9946
Larus Corporation®
1560 Berger Dr. • San Jose, CA 95112

Circle # 118



Why
Have
Two?

One butt set is all you need to talk and signal on Nortel Meridian Digital Centrex (MDC) and Analog lines.
The SBI-145 provides all the functionality you expect - and more!

DPL
TELECOM TECHNIQUES

A talent for listening.
A tradition of excellence.

1-800-561-8880 • Fax: 506-635-1057
www.dpl.ca

Circle # 119

Staying on Top Requires Superior Intelligence

Introducing...*Key World Telecom Markets '97*

America's Network, *Communicaciones*, and *Asia Telecom* magazines have teamed up with Market Tracking International, a leading international research firm, to bring you the most comprehensive and up-to-date single volume of information on the telecom market today.

Key World Telecom Markets '97 contains more than 500 pages of detailed global analysis, including 150 statistical charts and tables to help keep you and your company tuned into your competition and on top of potential opportunities worldwide.

Visit our website at www.americasnetwork.com to learn more about *Key World Telecom Markets '97*

Call 1-800-598-6008
Outside the U.S. 218-723-9180 • Fax 218-723-9146
Advanstar Marketing Services • Customer Service Dept.
131 W. 1st St. • Duluth, MN 55802

Products and Services

ATM network management system

The NetCoach expert network management system for ATM networks supports multiple vendor switches, solving the problem of managing across disparate hardware resources. Acting as a "mentor" to the network staff, the system supports ATM switch management from multiple vendors via a common console. By addressing the critical fault and performance management requirements of network managers, the system helps maximize the benefits of ATM networks.

The system also supports access to performance and fault information from common Web browsers allowing managers to keep on top of network status, performance and problems. Use of sophisticated algorithms to correlate ATM alarms, service degradations and performance problems in a multivendor environment is patent pending.

NetCoach is comprised of four key components, available individually or as an integrated solution:

- Performance manager—included with the base product, it allows network managers to examine network load and gain a real-time perspective on network activity.
- Fault Manager—provides network managers with a single console for fault manager, detection and resolution of faults and alarms generated by ATM switches from multiple vendors.

Distribution Manager—supports distribution of management data between multiple management centers and allows data to be shared between distributed sites.

- Simulator Manager—imports data from NetCoach PM to allow real-world traffic information to drive simulation and planning exercises. Provides managers with expert analysis for balancing systems workloads, supporting system decisions, and improving and maintaining service levels.

NetCoach pricing starts at $10,000.

Stanford Telecom (Sunnyvale, Calif.)

Visit www.stelhq.com or Circle 256

ATM network termination

ATM network termination units provide gateway functions and border control between public ATM services and local ATM networks. Installed at the customer's premises, Hunt 7000 standalone ATM network termination unit demarcates the end of the public ATM network, while supervising and ensuring committed quality of service (QoS).

The Hunt 7000 lets carriers meet end-to-end QoS commitments while protecting the public network from non-conferencing or unauthorized customer traffic. In addition, it supports customer requirements for stable service with facility protection and hot-swappable interfaces, while providing a scalable migration to more robust use of ATM.

The unit provides ATM port redundancy and the ability to hot-swap its line interface modules in the field. Through its three-port ATM connection, the unit provides ATM link redundancy to support mission-critical network applications and

ATM user concentration. In addition, it includes performance management supported for 256 VCs, full support in operations and maintenance (OAM) flow and usage parameter control (UPC) monitoring. These features are stored in a non-volatile database for billing conforming and non-conforming traffic.

Featuring rate and media adaptation with a variety of swappable physical interfaces, the unit addresses the connectivity requirements of ATM users and providers, including E1, T1, E3, T3 and OC-3/STM1 interfaces. It can be managed remotely. Hunt 7000 pricing starts at $4,500.

Hynex (Petach-Tikva, Israel)

Visit www.hynex.com or Circle 257

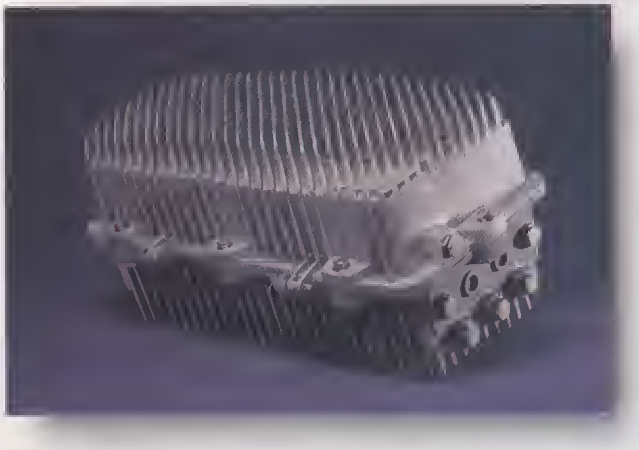
Scalable optical node

The PWRBlazer Scalable Node can be reconfigured and upgraded to meet future network demands, such as delivering Internet access, video-on-demand and other targeted services.

Each output port can be addressed by its own fiber pair, which enables the node to scale its output to provide dedicated bandwidth for delivery of advanced data services to the home. Support for redundant optical receivers, return transmitters and power supplies allows operators to configure the node for a high degree of fault-tolerance for the most demanding network applications. Eight optical module slots can accommodate any combination of plug-in forward receivers and return oath transmitters. Up to four output ports allow operators to configure each node with the number of output ports required for a particular network application. Finally, one or two housing ports are routed for direct return signal input to a dedicated return transmitter.

Harmonic Lightwaves (Sunnyvale, Calif.)

Visit www. harmonic-lightwaves.com or Circle 259



New product information should be submitted to Debbie L. Sklar, Solutions editor, at *America's Network*,

714/513-8698; Fax: 714/513-8634

dsklar@americasnetwork.com

Send Your Equipment Alarms Directly To Alpha Pagers!

Additional messages will be sent to your Network Monitoring System or T/MonXM too!

Alpha Max-82S™
- 8 Inputs, 2 Relay Outputs

Discrete Point Module (DPM)™
- 16 Inputs, 2 Relay Outputs

Both units come with built-in modems, ASCII "reach through" ports, support for alpha and numeric pagers and are wall or rack mountable. Use to monitor your tower lights, environmentals, CEV's, huts, major and minor alarms, etc.

If equipment alarms are important to your business, then DPS has the products you need to effectively manage those alarms! From small 8 point units to full blown multi-user graphics monitoring masters, we have the solution to your monitoring needs. **CONTACT US NOW! We are here to help.**

GUARANTEED TO BE TIME, COST AND LABOR SAVING OR RETURN FOR A FULL REFUND!

Call Now DPS INC Call Now

"Your Partners in Telemetry Monitoring Systems"

(800) 622-3314 • (209) 454-1600 • FAX (209) 454-1688
VISIT OUR WEB SITE http://www.dpstele.com

Circle # 120

RADCOM Keeps ISDN Clean!

Dual Action WAN/LAN/ISDN Analyzer spots problems on both sides of the network!

- ISDN - Dual Channel
- Simultaneously monitor both sides of the network
- Test over 160 protocols: Frame Relay, SMDS, ISDN...
- All popular interfaces
- PPP/Async
- Easy to use Windows GUI
- DataKit support
- Less than 5 pounds

RADCOM

Phone: 1-800-RADCOM-4 201-529-2020 Fax: 201-529-0808
E-Mail: 74777.3702@compuserve.com Web Site: http://www.radcom-inc.com

Circle # 121

Itinerary

Date	Event	Organizer/Sponsor	Location	For Information
Jan. 20–23	**Supercomm Mexico**	**Telecommunications Industry Assn.**	**Mexico City**	**703/907-7700**
Jan. 21–23	Wireless Showcase Asia	Personal Communications Industry Assn.	Singapore	703/739-0300
Jan. 26–28	**Winter Carrier Forum**	**Telecommunications Resellers Assn.**	**Dallas**	**202/835-9898**
Jan. 26–29	ComNet '98	IDG Communications	Washington	800/225-4698
Feb. 1–3	**Using Call Centers to Gain Competitive Advantage**	**Strategic Research Institute**	**Scottsdale, Ariz.**	**800/599-4950**
Feb. 4–5	Convergence Billing '98	Institute for International Research	Dallas	888/670-8200
Feb. 9–12	**Western Communications Forum**	**International Engineering Consortium**	**Dallas**	**312/559-4111**
Feb. 10–11	Wireless Interconnection '98	Bellcore	Orlando, Fla.	800/521-2673
Feb. 10–12	**Internet Expo**	**Digital Consulting Institute (DCI)**	**San Jose, Calif.**	**978/470-3880**
Feb. 10–12	Wireless Symposium Exhibition/ Portable By Design	Penton Institute	Santa Clara, Calif.	800/696-6023
Feb. 10–13	**ExpoComm Mexico'98**	**E.J. Krause & Assoc. Inc.**	**Mexico City**	**301/493-5500**
Feb. 11–13	Year 200 Testing, Strategies & Solutions	Digital Consulting Group (DCI)	Phoenix	978/470-3880
Feb. 15–19	**NTCA Annual Meeting & Expo**	**National Telephone Cooperative Assn.**	**Atlanta**	**202/298-2328**
Feb. 15–20	Implementation Comference	The Data Warehousing Institute	San Diego	972/578-5022
Feb. 18–20	**Louisiana: Annual Convention**	**Louisiana Telephone Assn.**	**New Orleans**	**504/927-1377**
Feb. 22–27	Optical Fiber Communication Conference and Exhibit	Optical Society of America/IEEE	San Jose, Calif.	202/223-0920
Feb. 23–25	**Wireless '98**	**Cellular Telecommunications Industry Assn.**	**Atlanta**	**800/424-5249**
Feb. 24–25	Performance Indicators & Benchmarking	Institute for International Research	Key Biscayne, Fla.	888/670-8200
Feb. 24–27	**Comdex Mexico**	**E. J. Krause & Assoc. Inc.**	**Mexico City**	**301/493-5500**
Feb. 25–26	IMT 2000 Wider Band CDMA Conference	Wireless Institute of Technology	Atlanta	510/490-6459
March 3–6	**Global TMN Summit**	**Vertel**	**Orlando, Fla.**	**818/227-1424**
March 10–12	Telecom Business/ TeleCard World	MultiMedia Publishing Corp.	Dallas	713/974-5252
March 15–18	**WRTA Convention**	**Western Rural Telephone Assn.**	**Las Vegas**	**707/538-7755**
March 16–18	Customer Care Conference	Institute for International Research	Coconut Grove, Fla.	888/670-8200
March 22–25	**MTA Annual Convention**	**Minnesota Telephone Assn.**	**Minneapolis**	**612/291-7311**
March 23–25	Calling Party Pays	Institute for International Research	San Francisco	888/670-8200
March 24–27	**Carolinas, Virginia: Spring Meeting**	**Carolinas-Virginia Membership Assn.**	**Williamsburg, Va.**	**910/592-5751**
March 30–April 2	InterComm '98	Telecommunications Industry Assn.	Toronto	703/907-7700
March 31–April 3	**Telexpo '98**	**Telecommunications Industry Assn.**	**São Paulo, Brazil**	**703/907-7700**
April 1–2	North Dakota: Annual Meeting	North Dakota Telephone Assn.	Bismarck, N.D.	701/223-6022
April 15–17	**TeleCon East**	**United States Distance Learning Assn./ GE Spacenet**	**Washington**	**800/829-3400**
April 20–23	Expo Comm USA	E. J. Krause & Assoc. Inc.	Chicago	301/493-5500
April 28–May 1	**Communications '98**	**E. J. Krause & Assoc. Inc.**	**Beijing**	**301/493-5500**
May 3–6	Cable '98	National Cable Television Assn.	Atlanta	202/775-3669
May 12–16	**Sviaz/Expo Comm Moscow**	**E.J. Krause & Assoc. Inc.**	**Moscow**	**301/493-5000**
June 7–11	Supercomm'98	U.S. Telephone Assn./TIA	Atlanta	703/907-7700

WITH THE WIDEST RANGE OF EASY-TO-INTEGRATE DSL-BASED SOLUTIONS, WE ELIMINATE ALL HURDLES AND FREE YOU TO DELIVER NEW SERVICES TO MARKET FASTER. At PairGain, our focus is on delivering innovative end-to-end DSL systems over your copper infrastructure, letting you and your customers quickly and easily take advantage of the industry's latest innovations. As a global leader in DSL, with the largest installed base, we offer a full portfolio of solutions to deploy a variety of services allowing you to generate revenue fast. This ranges from our HiGain T1/E1 HDSL systems and PG-Flex and PG-Plus Subscriber Carrier systems, to our Campus Area Network and Megabit Access solutions. All with comprehensive network management. Plus, PairGain's field service provides the industry's most complete customer support, including training and installation. And you can expect 24 hour product delivery that comes with our quality guarantee. Put the PairGain advantage to work for you. Call us at 1-800-370-9670. Or visit www.pairgain.com.

PAIRGAIN

OUR FOCUS · YOUR ADVANTAGE
NO WONDER OUR CUSTOMERS FINISH FIRST.

See us at ComNet Booth 1246

Circle 123

Each and every month America's Network brings to you an up-to-date selection of products, services, seminars and career opportunities in our *Career & Development Showcase* and *Products and Services Showcase.* Check it out every month!

America's Network

FOR ADVERTISING INFORMATION AND AD PLACEMENT, CONTACT:
Denise Kokai, 440-891-3163
1-800-225-4569 (ext. 163)
Fax 440-826-2865
dkokai@advanstar.com

For all ads under $250, payment must be received by the classfied closing date. VISA, MASTERCARD, AMERICAN EXPRESS accepted. **Send ad copy to:** Advanstar Marketing Services, 7500 Old Oak Blvd., Cleveland, OH 44130.
Send blind box replies to: America's Network Classified, 131 W. First St., Duluth MN 55802 (include box number in address).

CAREER & DEVELOPMENT

BUTLER TELECOM

IMMEDIATE OPENINGS NATIONWIDE

CENTRAL REGION	800-365-9675
RF Testers/Engineers, PCS/ Cellular, Satellite and Microwave Technicians	
PACIFIC REGION	800-422-4730
Splicers, OSP Engineers, I&R Technicians, RF Testers/ Engineers	
NORTHEAST REGION	800-345-4491
C. O. Engineers & Frame Administrators	
SOUTHEAST REGION	800-241-6220
Project/Product Managers, COE Maintenance Technicians	
IN, OH, IL, MI	800-888-8412
RF Testers/Engineers, Power Systems Installers, Technical Support Engineers.	

COE Installers, Engineers and Testers needed in all regions.

EOE M/F/V/D

OFFICE MANAGER / ACCOUNTANT

BENTON COOPERATIVE TELEPHONE COMPANY is seeking an office manager/accountant. This is a department head position responsible for all accounting and office manager functions. Ideally the candidate should have an accounting degree along with four or more years of telecommunications accounting experience. Resumés and information requests should be directed to: Nicholas R. Prom, General Manager, Benton Cooperative Telephone Company, 2220 125th St. NW, Rice MN 56367-9701, 320/393-2115, FAX 320/393-2221

WIRELESS CONSULTANT

GVNW Inc./Management is currently accepting resumes for the position of Wireless Consultants in our Kerrville, Texas office. Successful applicants will have extensive experience in implementing wireless telecommunications operations. Management, marketing and accounting experience required. Thorough knowledge of wireless interconnection agreements, tariffs, and toll resale markets desired. Send resume, references, and salary requirements to:

GVNW Inc./Management
HR-ANTXWC 1297
P.O. Box 25969
Colorado Springs, CO 80936

COMMUNICATIONS TECHNICAL TRAINING

"Training Increases Productivity"

- **Transmission**
- **Power**
- **Monitoring**
- **Standard & Custom Courses**

Structured learning environment, hands-on applications, personalized attention and effective task-based course materials. Call toll-free to receive a FREE catalog of detailed course descriptions.

(800) 398-8867

RELTEC™

SUPERINTENDENT of CABLE TV & DIGITAL SERVICES

Municipal Cable System with 10,000+ analog subscribers, is currently overbuilding to a new hybrid fiber-coax system. Currently evaluating strategic alliances with digital satellite, internet and telco providers to expand and consolidate these services into our franchise. A key technical management position exists for the right individual who can provide leadership to the existing supervisory staff in this transition. Responsibilities require abilities in the named technologies, as well as promotion and contract administration, studio management, etc. under the direction of the General Manager.

Qualifications: BS in Electronics or Electrical or other degrees in closely related fields, with strong technical and administrative experience preferred. This is a rewarding career opportunity or unique interdisciplinary stepping stone to advancement to a larger enterprise. Send letter of application, resume and phone numbers to three references to:
Thomas M. Daly, General Manager
City of Wyandotte
Department of Municipal Service
3005 - Biddle Ave.
Wyandotte, Michigan, 48192.
Fax to (313) 282-5822.
Application deadline February 16, 1998.
Residency Requirement.

America's Network

FAST ACTION POSTCARD DECK

A highly targeted and cost-efficient direct response card deck reaching over 50,000 decision makers throughout the new public network!

CONVENIENT & EASY TO USE — IDEAL FOR

- Generating sales leads
- Distributing special offers
- Testing product ideas
- Testing price points
- Promoting new or existing products
- Inviting attendees to trade shows, seminars, conferences

CONTACT: DENISE ADKINS-KOKAI
800-225-4569 EXT. 163 • 440-891-3163
FAX: 440-826-2865

AMERICA'S NETWORK CUSTOMER SERVICE

PUBLISHER
Paul Semple
312 W. Randolph St., Suite 600
Chicago IL 60606-1721
☎ 312/553-8920
fax 312/553-8926
psemple@americasnetwork.com

GENERAL MANAGER
Danny Phillips
201 Sandpointe Ave., Suite 600
Santa Ana, CA 92707-8700
☎ 714/513-8466
fax 714/513-8634
dphillips@americasnetwork.com

ADVERTISING PRODUCTION MANAGER
Julie Koerber/Tony Rahal
Send ad materials to:
201 Sandpointe Ave., Suite 600
Santa Ana CA 92707-8700
☎ 714/513-8408
fax 714/513-8693
jkoerber@advanstar.com

SENIOR PUBLISHER
Ray Smith
BUSINESS MANAGER
Colette O'Donnell
PRODUCTION DIRECTOR
Mike Weldon
CIRCULATION MANAGER
Henry Fung
PROMOTION DIRECTOR
Susan Dobak
INTERNATIONAL LICENSING
Tammy Lillo

CHAIRMAN & CEO
Robert L. Krakoff
VICE CHAIRMAN
James M. Alic
V.P.-BUSINESS DEVELOPMENT
Skip Farber
V.P.-STRATEGIC PLANNING
Emma T. Lewis
EXECUTIVE VICE PRESIDENTS
Kevin J. Condon
Alexander S. DeBarr
Brian Langille
Glenn A. Rogers
V.P.-FINANCE; CFO; SECRETARY
David W. Montgomery
TREASURER & CONTROLLER
Adele D. Hartwick

FOR EDITORIAL CONTACT INFORMATION: See page 6.

Editorial submissions: Send press releases and other information to the Santa Ana, Calif., address. All submitted material will be handled with reasonable care; however, *America's Network* assumes no responsibility for safety of submitted artwork, photographs or written material. Materials accepted for publication will not be returned. To obtain guidelines for contributed information and manuscript proposals, call Rebecca Ittner at 714/513-8422.

Descriptions of commercial products and services are at times based in part on information supplied by vendors. *America's Network* assumes no responsibility for any false or misleading claims that may appear in vendor-contributed descriptions.

America's Network evaluates emerging technologies, from a business-case perspective, for those who conceive, design and run America's public network. It is written for those responsible for design, deployment, operation and maintenance of public network elements. Readership includes local and long distance telephone companies, CATV companies, competitive access providers, wireless network operators, resellers, computer companies, and telecommunications industry suppliers and consultants.

www.americasnetwork.com

ADVERTISERS' INDEX

Advertiser	Page	RS#
ADTRAN Inc. www.adtran.com	37	107
DPL Telecom Techniques www.dpl.ca	96	119
DPS Inc. www.dpstele.com	97	120
Electrodata Inc. www.electrodata.com	05	101
Fluke Corp. www.fluke.com/nettools	41	108
Hadax Electronics www.hadax.com	81	110
Hekimian Laboratories www.hekimian.com	07	102
Hendry Telephone Products www.hendry.com	12	105
IQPC www.iqpc.com	CV3	—
Larus Corp. www.laruscorp.com	84	111
Larus Corp. www.laruscorp.com	93	116
Larus Corp. www.laruscorp.com	95	118
MultiMedia Publishing Corp. www.mpcshows.com	29	—
Network Design and Analysis Corp. www.ndacorp.com	09	103
Newton Instruments www.newtoninst.com	35	106
Nortel www.nortel.com	CV2-03	100
Pair Gain Technologies Inc. www.pairgain.com	99	123
Positron Fiber Systems www.positronfiber.com	89	114
Precicontact —	11	104
Professional Systems Inc. www.shelters.com	95	117
RADCOM Equipment Inc. www.radcom-inc.com	97	121
Sunrise Telecom support@sunrisetel.com	90	115
Tandem Computers www.tandem.com	42-43	109
Tekelec www.tekelec.com	CV4	122
Tektronix www.tek.com/mbd/ad?1025	32-33	—
Telco Systems www.telco.com	85	112
United States Postal Service —	44	—
Wiltel www.willtales.com	86	113

The advertisers' index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

ADDITIONAL SERVICES

To purchase issues, call toll-free:
800/598-6008 (outside the U.S.: 218/723-9180).
- Single copies: $6 (U.S.); $8 (Canada & Mexico); $10 (all other countries).
- All rates include shipping & handling, and are payable in U.S. funds drawn on a U.S. bank.

To subscribe, call toll-free:
888/527-7008 (outside the U.S.: 218/723-9477).
Subscription rates:
- U.S. & Territories: one year $75; two years $95
- Canada & Mexico: one year $95; two years $135
- All other countries: one year $115; two years $175
  (incl. $95/year extra for air-mail delivery)

To order reprints (100 minimum), call:
Brian Kanaba at 440/891-3155; fax 440/826-2865.

To obtain microform copies (film or fiche), call:
Marketing Services at 800/598-6008, outside the U.S. 218/723-9180.

For list rentals, call: Mike Balzano at 440/891-2697; fax 440/826-2865.

For classified ad, directory, buyers guide and postcard information, call: Danielle Gundling at 440/891-3153; fax 440/826-2865.

America's Network (ISSN-1075-5292, USPS 576-650) is published the 1st and 15th of every month by Advanstar Communications Inc. Corporate offices: 7500 Old Oak Blvd., Cleveland OH 44130. Advertising offices: 7500 Old Oak Blvd., Cleveland OH 44130 and 312 W. Randolph St., Chicago IL 60606. Accounting & circulation offices: 131 W. First St., Duluth MN 55802.

Copyright © 1998 by Advanstar Communications Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including by photocopy, recording or information storage and retrieval system, without permission in writing from the publisher. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Advanstar Communications for libraries and other users registered with the Copyright Clearance Center, 222 Rosewood Dr., Danvers MA 01923; ☎ 508/750-8400; fax 508/750-4470; call for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. For those not registered with the CCC, forward permission requests in writing to Maureen Cannon, Advanstar Communications Inc., 7500 Old Oak Blvd., Cleveland OH 44130.

Canadian G.S.T. number R-124213133. IPM Number 841773.

Office of Publication: Advanstar Communications Inc. 131 W. First St., Duluth MN 55802. Periodicals postage paid at Duluth MN 55806 and additional mailing offices.

POSTMASTER: Send address changes to America's Network, P.O. Box 6100, Duluth MN 55806.
Date: Jan. 28, 1994. Printed in the U.S.A.

ISSN-1075-5292 (USPS 576-650)

COMING UP...

February 1
Timing & synchronization/ Optical switching

February 15
Wireless data

March 1
Network management

March 15
Intelligent networks

April 1
Testing & monitoring

April 15
Data management/storage

ADVERTISING SALES STAFF

UNITED STATES

WEST
Bob Kirstine
Leah Vickers
Kimberly Daniels
Kirstine & Co., Inc.
6615 E. Pacific Coast Hwy., Suite 285
Long Beach, CA 90803
☎ **562/493-5434**
Fax: 562/493-1564
rkirstine@earthlink.net
lvickers@earthlink.net
kimdaniels@earthlink.net

CENTRAL
Bob Ohlsen
Advanstar Communications
7500 Old Oak Blvd.
Cleveland, OH 44130
☎ **440/891-2682**
Fax: 440/891-2675
bohlsen@advanstar.com

SOUTHEAST
David Morrison
Advanstar Communications
270 Madison Ave., Ste. 600
New York, NY 10016-0695
☎ **212/951-6749**
Fax: 212/683-4257

NORTHEAST
Michael Lamattina
Advanstar Communications
270 Madison Ave., Ste. 600
New York, NY 10016-0695
☎ **212/951-6611**
Fax: 212/683-4257

GLOBAL SALES DIRECTOR
Alan El Faye
Advanstar Communications
201 Sandpointe Ste. 600
Santa Ana, CA 92707-8700
☎ **714/513-8675**
Fax: 714/513-8634
aefaye@advanstar.com

INTERNATIONAL

ASIA PACIFIC

ASIA & PACIFIC
Gigi Chan
CCI Asia-Pacific Ltd.
Unit 101 - 1/F, Pacific Plaza
410 Des Voeux Road West
Hong Kong
☎ +852-2964-1303
Fax: +852-2857-6309
telecomasia@cci.com.hk

JAPAN
Eiji Yoshikawa
EMS Inc.
2-22-8-205 Matsubara
Setagaya-Ku, Tokyo 156
Japan
☎ +81-3-3327-2688
Fax: +81-3-3327-3010
callems@msn.com

KOREA
J. W. Suh
Hau International
C.P.O. Box 4072
Seoul
Korea
☎ +822-7200-121
Fax: +822-7200-122
hauintl@chollian.dacom.co.kr

EUROPE

FRANCE, LUXEMBOURG, BELGIUM, NETHERLANDS
Stephane de Remusat
REM International
24 Bis RueGallieni
91560 Montmorency
France
☎ +33-1-39-89-96-00
Fax: +33-1-39-89-63-41
srem@compuserve.com

GERMANY, AUSTRIA, SWITZERLAND
Friedrich Anacker
InterMedia Partners GmbH
Deutscher Ring 40
43247 Wuppertal
Germany
☎ +49-202-71-1091
Fax: +49-202-71-2431
mail@impgmbh.de`

UNITED KINGDOM
Dee Wakefield
Advanstar Communications
la Gregory Place
Kensington; London W8 4NG
England
☎ +44-171-938-1199
Fax: +44-171-938-4555

SCANDINAVIA, ITALY, SPAIN, PORTUGAL
Zena Coupe
Amanda Blaskett
A-Z International Sales Ltd.
70 Chalk Farm Road
London MW1 8AN
England
☎ +44-171-284-3171
Fax: +44-171-284-3174
azintuk@compuserve.com

ISRAEL

Marcus Sheff
Intermedia, The World Shop Ltd
P.O. Box 3348
Ramat Gan 52133
Israel
☎ +972-3-575-4426
Fax: +972-3-751-0687
tws@mail.netvision.net.il

www.americasnetwork.com

Last Call

ALAN PEARCE

Bless those resellers

Keep your friends close, your 'enemies' closer.

Resellers have become an integral part of the industry. But until recently, major carriers hated them, because they were created by federal policy and because most carriers believed resellers "poached" their major customers. This industry has been marked by poor carrier-reseller business relationships from the beginning. This has neither benefited the public, nor has it helped carriers and resellers that should be working together to increase sales and market penetration.

AT&T has reluctantly confronted the fact that it cannot be all things to all of its customers.

Although the historical situation is understandable (indeed, both parties have some justifiable complaints against each other), a period of harmony may be on the horizon.

It's easy to assign blame for the current malaise. Carriers blame the FCC (which developed the resale and shared-use policies in the 1970s) and the resellers (as some are alleged to be unethical). Resellers claim that carriers, accustomed to believing that they know everything about marketing and sales, tolerate resellers merely because of a federal mandate. As a result, resellers constantly seek protection from the FCC, the courts and even Congress.

USING AT&T'S 'GOOD' NAME

Things may improve, thanks partly to AT&T and to the fact that the services market is beginning to change dramatically. AT&T got the ball rolling in late 1997 when it boldly announced that it would permit other entities, including resellers, to use its brand name to extend its vulnerable market leadership in long-haul and wireless services. This was a brave admission that the former monopolist was unable to stand alone serving all aspects of the market.

As the industry becomes competitive, incumbent carriers (if they are to survive) will need to evaluate their sales and distribution channels using a more mature framework than they have in the past, and major carriers will need to work harder to establish sustainable competitive advantages. In the aggregate, resellers represent low volume for carriers. The fact that many carriers, fearing FCC policies and/or potential litigation, believe they cannot require an exclusive relationship with resellers means that the carriers cannot control how resellers market the carriers' services.

However, resellers that service niche markets, bundle services with other products and services, and use the network in innovative ways could become valuable partners for major carriers. As competition intensifies, there will be several implications, some of which are already emerging:

- Carriers will depend more on resellers, agents and other third-party marketing channels as the industry matures.
- Resellers that attempt to sell to the same large market segments as carriers will survive only if they add value, either through close, confidential client relationships or by packaging and bundling services and equipment unmatched by the incumbent carriers.
- Exclusive relationships between carriers and resellers will evolve, whereby carriers will support reseller sales and marketing efforts in the (reluctant) knowledge that carriers cannot be all things to all customers.

FCC POLICIES ARE OUTDATED

Just as the carriers need to adjust their strategies to grapple with a more dynamic and competitive environment, so, too, will regulators and policy-makers. The FCC has played a major role in carrier-reseller relationships since the 1970s; but those policies may be too costly for the players. By explicitly pitting facilities-based competitors against one of their key marketing channels, the FCC creates an environment that drives up transaction costs between parties.

FCC policies were designed to foster competition, not trust and cooperation. But these policies emerged when the industry was monopolistic. Today, it's increasingly competitive, and carriers must develop close, cooperative and exclusive relationships with resellers so they can compete with other carriers, rather than with their own sales and distribution channels.

One way the FCC can reduce its workload significantly over the next several years is to revisit the resale policies of the 1970s and 1980s to bring them in line with today's market realities. If and when it does, everyone will win. ■

Alan Pearce is president of Information Age Economics Inc. (Washington). He can be reached at 202/466-2654.

Carry *High-Speed* Data
Over Copper with SPEEDPORT™

and

Gain *New* Customers
at Record *Speed.*

Use xDSL to Build Your Business ASAP.

Today's sophisticated residential and small office users demand fast Internet access and remote LAN connectivity. Meet this demand for high-speed multimedia services over your existing twisted-pair copper with Fujitsu's SPEEDPORT™ DSL system—the first solution to offer POTS plus SDSL or ADSL from the same hardware platform.

More Bandwidth, Lower Cost.

Fujitsu's business case, customized for your network and competitive situation, allows you to give customers far more bandwidth while minimizing access costs, operations resources and backbone costs. We can show you how to build revenue—and profits—with a customer-friendly DSL service priced to gain subscribers easily.

Proven Technology, Available Now.

DSL BY ORCKIT

Based on proven core technology from Orckit Communications, the SPEEDPORT system alleviates switch congestion while managing the traffic load on your SONET/ATM backbone. Your customers will enjoy SDSL speeds six times that of ISDN connections. And ADSL speeds 250 times faster than analog modems. To learn more, call Fujitsu Network Communications, Inc. at **1-800-777-FAST** or e-mail us at **fast@fujitsu-fnc.com**.

FUJITSU

Building Networks
that
Build Your Business.

www.fnc.fujitsu.com

Circle 124

Local Number Portability. Start with a solid foundation and feel confident.

Will your STP-SCP configuration meet the demands of local number portability?

Tekelec's EAGLE STP with integrated LNP offers a solid foundation, designed to meet and exceed any LNP needs now and for the future. Already the EAGLE can process 20,000 translations per second with 8 million entries!

In addition the truly scalable EAGLE STP serves small applications right up to the largest metropolitan area needs.

Find out why many of the most respected names in telecommunications have already selected the EAGLE STP. The EAGLE STP offers the best cost performance in the market today.

www.tekelec.com
919-460-5500

TEKELEC

More Than Technology...Expertise

Corporate Headquarters 26580 West Agoura Road, Calabasas, California 91302
Network Switching 5151 McCrimmon Parkway, Morrisville, North Carolina 27560

Circle 122